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ENGINEERING AND MINING JOURNAL

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Sir Edmund Davis

An Interview

By GEORGE L. WALKER

Famous English Mining Director Discusses Mineral Resources of Rhodesia

■

The Discovery-Depletion Clause

By GRANVILLE S. BORDEN

Suggested Revision of 1928 Revenue Act of Interest to Mining Engineers

■

Aërial Photography's Aid to Mining

By H. I. SMITH

Mosaic of the Oklahoma Zinc District Has Many Interesting Uses

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Discovery-Depletion Clause Needs Simplification

THE discovery-depletion clause of the Revenue Act of 1928 is apparently well intended, but its framers could not have appreciated its vagueness, and the resulting uncertainty as to its interpretation. As it now stands it will be necessary to refer most of its provisions to the courts for clarification. Mr. Granville S. Borden, in another place in this issue, dissects the vagaries of the discovery-depletion clause. Neither tax gatherer nor tax payer can be sure of its meaning. The basic principle of depletion has been generally recognized as equitable in its application to producing mineral properties. A simple procedure for the determination of depletion should therefore be fundamental in the income-tax law. Petroleum producers have been more fortunate than other mineral producers in securing a percentage of gross income for depletion. As Mr. Borden points out in his able paper, a similar provision applicable to metal-bearing and other mineral deposits would remove most of the present difficulties. Such legislation should be enacted, and the miners paying income tax should direct their earnest attention toward securing a fair depletion allowance that can be determined in a simple way.

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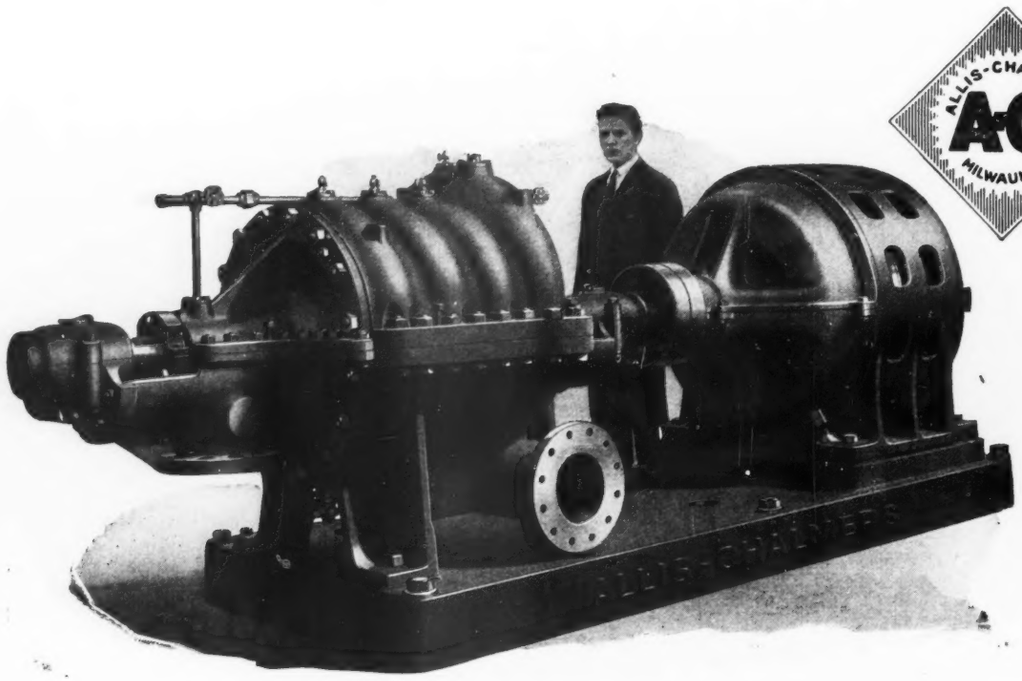

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Awaiting the Outcome of Majority Decision

ENGINEERS, with an appreciation of the wastefulness of friction and the hazard of disrupting smooth human relationships, will experience a deep sense of relief at the termination of the political campaign now in its final phase. For the first time in history a mining engineer rose to such national and international eminence that he became the logical candidate for the highest honor in the gift of the people of the United States and was, in consequence, drawn into the maelstrom of political controversy.

For his attitude of fairness throughout the campaign Mr. Hoover has earned the respect of many who heretofore have not been privileged to observe his character at close range, or to follow his technical, administrative, and executive achievements in the many capacities in which he has served his country, his profession, and the world at large. Abandoning a lucrative practice in a determination to carry through to a successful conclusion the great task to which he had set his hand at the outbreak of the war, unconcerned in those days with what the outcome to himself would be and little suspecting his own power to become a world figure, Mr. Hoover, in recompense for his services to others, has been unconsciously shaping his own destiny toward an objective the attainment of which will rest with the people of the United States on November 6.

The campaign now coming to a close has been informative and inspiring in at least two respects. It has been a privilege for many engineers to correct propaganda that pretended knowledge but merely disclosed ignorance. A political contest was apparently necessary, for instance, to uncover the amazing fact that an editorial writer on the staff of one of the greatest newspapers in the United States was under the impression that Mr. Hoover's *magnum opus* was a book on agriculture; it disclosed, moreover, the spread of an attempt by the son of a former President of the United States to belittle so monumental a work on ancient mining methods by a contemptuous reference to Mr. Hoover's alleged qualifications in translating plays from the Latin!

Mr. Hoover's associates and colleagues, who have seen how business has benefited from his wise counsels and organizing ability, how he fought the effect of catastrophe here and abroad with an unselfish devotion to a high purpose, will have felt sympathy with him in some of his experiences of the past few months. They will be proud that he has borne himself with commendable dignity in the face of blustering attack, putting into practice a conception of fair play that would be expected from one whose professional record and standing as a citizen remain unsullied, and whose intellectual and human attributes have easily survived distortion of fact.

The outcome of the pending election will decide if an engineer not skilled in political subterfuge shall assume a great honor and a great responsibility. If the country voices its appreciation of Mr. Hoover's past services, and indicates its faith in him as a leader, the profession and industry of mining engineering will share in the acclaim and take pride in the culminating achievement of a career that always has been and will remain an inspiration to its members.

A Successful Product May Find Use in Many Industries

WOOD PULP used in the manufacture of paper may be primarily divided into two classes, according to whether it remains in the raw state or is chemically treated. Raw wood pulp is termed mechanical pulp in the industry; and the two principal chemical products are designated sulphite and sulphate, or kraft, respectively. In a previous editorial was discussed the scope for the replacement of many of the machines known as beaters or Jordans, used for shredding the fiber after chemical treatment, by modern rod mills developed in the nonferrous metallurgical field.

About 1½ million tons of mechanical pulp is produced yearly in the United States by an initial shredding process that involves the pressing of the logs against revolving sandstone cylinders, the operation being accompanied by the use of large volumes of water. The yearly domestic output of these pulpstones, as they are called—from West Virginia and Ohio, and the State of Washington—is valued at about one million dollars; Canada is an importer and England an exporter of them.

Sandstone would seem to lack the properties needed for such a purpose as shredding. It is a successful abrasive, and tears a good fiber from the wood, but wear is excessive and contamination of the pulp is unavoidable. Moreover, the peripheral speed of the grinder must be regulated according to its decreasing circumferential measurement. Something harder than sandstone is needed. Sectionalized artificial pulpstones faced with silicon carbide have been tried, according to Mr. V. L. Eardley-Wilmot, of the Canadian Department of Mines, who contributes the article on abrasives in *Mineral Industry*.

In improving the initial step of preparing mechanical pulp, however, the paper industry may profit by recent work done in the mining and metallurgical industries, in

line with the policy that prompted investigation of the metallurgical rod mill as a substitute for beaters and Jordans for shredding chemical and other forms of fiber pulp. A consideration of outstanding developments in the production of a hard abrasive prompts attention to the interesting work done in recent years in the substitution of a metallurgical alloy in place of diamonds as a facing material in oil-well drilling tools. The success for this purpose of a special combination of tungsten and carbon, known as "borium," suggests that many other applications may be found for this novel compound. The alloy is made in the form of sticks, granules, and small pieces inclosed in a jacket of mild steel. In the facing of an oil-well bit, the "borium" granules are welded to a tool with a high-carbon rod and then faced with an alloy of lower resistance in the scale of hardness. The oxy-acetylene torch—a familiar tool in mine shops, with an operating technique as well understood as is that of the lathe and drill press—is used.

Many inquiries have been received asking for information about "borium." Until an investigation was made the word was thought to be a mistake for barium. Not so, however. It is not a new element but a name given to a substitute for the diamond, a name selected apparently because of its successful use in *boring* operations! The development is of interest. The diamond is an element, and it cannot be artifically made except in small crystals of no commercial importance; but the successful use of a synthetic substitute in oil-well drilling indicates the scope for research and the opportunity that exists for the interchange of ideas and experiences among operators in the various technical industries. An alloy that has proved successful for scouring a hole in an oil formation may prove equally successful for the shredding of wood fiber. Dissemination of information on progress will help all concerned.

Arbitration as Insurance Against Disputes

ACCEPTANCE of the principle of arbitration with respect to the settlement of industrial disputes is somewhat like taking out insurance against death or disability. It really is insurance of a kind—insurance against the delays of litigation and even against litigation itself. The mere existence of an agreement to settle difficulties without resort to litigation makes those who subscribe to it less likely to disagree. By virtue of their compact they are on a friendly footing at the outset of negotiations. The ice is broken between them, to change the metaphor, and greater frankness is likely to mark their dealings.

Mining companies have been slow to endorse the principle of arbitration. How different things might have been had the endless disputes over apex rights been arbitrated instead of being fought to a finish in courts of law! Only in the zinc and slate industries has the idea received approval. This is doubtless because each of these industries has an efficient trade association through which the member companies may receive and act upon a proposal of this sort. Up to last June the American Zinc Institute had merely passed a resolution endorsing arbitration and had appointed a committee to inquire into the advisability of adopting rules of procedure. At the June convention, however, the committee submitted a definite plan to be followed when a dispute is to be submitted for decision. The machinery is now available. It remains to popularize the plan throughout the zinc industry by a campaign of education and to win for it increased interest and approval throughout all industries.

Initiative, Like Virtue, Is Often Its Own Reward

OUR metropolitan newspapers recently carried items relating to the career of Jean Leroy, whose poverty is said to have been due to his failure to patent basic features in the construction of the motion-picture projector for which he was responsible. It appears from the accounts that Leroy in 1875 began research in an endeavor to project on a screen a continuous picture from sequence photographs. This proved practicable, the noise made by the apparatus being the main obstacle to general acceptance. He persevered, however, and when the continuous motion-picture film was developed he invented essential features of the apparatus that permitted its projection. Applications covering these features, however, he failed to file, thereby losing financial interest in one of the most lucrative industries of the century. In 1912, in referring to the account, his claim to inventor's rights was recognized and upheld by the United States Supreme Court, and the monopolistic control of others was thereby broken. The time limit had expired, however, and so he gained nothing for his initiative and diligence beyond personal satisfaction and a fleeting public recognition of his work. Neither helped to support him and his family or to lessen a bitterness of outlook engendered by financial failure in spite of technical success.

The accuracy of the story is not guaranteed, but why is it that successful business is often so contemptuous of and ungenerous to the inventor? One reason may be found in the fact that recognition involves financial outlay. The executives interested are invariably fair-minded and scrupulous, but an unsympathetic propaganda advocating group research is causing them to disparage the work of what was recently termed the "garret genius." Moreover, mention of infringement of patents causes immediate alarm. The matter is placed in the hands of shrewd attorneys, possessed neither of the milk of human kindness nor the bowels of compassion, whose job is to prove that the original inventor is undeserving of recompense or consideration. Rare is the inventor possessed of capital to put up a fight. To interest others in his claim is well-nigh hopeless. The opposing array of legal talent, skilled in subterfuge, is overwhelming in influence; and, except in rare instances, the issue seldom gets as far as a court of law. He goes under, smarting under what he feels is an injustice. The legal department of the winning side is congratulated, and the directing heads of the organization, unaware perhaps of antecedents and details, and oblivious to the effects of the outcome on initiative in others and good will toward themselves, are content with a renewed sense of security.

A serious obstacle that confronts the inventor to capitalize on his invention is the cost of patenting and the time involved in educating the average patent

attorney in the intricacies of his calling and details of his work. Some engineers are avoiding these disadvantages by preparing and filing their own applications, which is entirely practicable, thereby avoiding an expense that is usually too heavy to be met in the early stages of the development of an invention.

Rarely can a valid excuse be offered for failure to secure, or at least to apply for, patent protection—to get evidence of initiative and diligence on record in chronological form. No solution of the existing problem can be found in the suggestion recently made that the man with an inventive turn of mind should join the ranks of a research organization as an alternative to starving. Individuality is still a common characteristic of creative effort; and although many inventors are unreasonable in their demands, and over-enthusiastic as to the value of their creations, it is as well to realize that to such initiative is due much of the progress made in recent years.

It may be impossible to recompense inventors in proportion to benefits accruing to humanity at large by reason of their initiative and diligence, but society should continue to protest when there is evidence that the rewards of invention are being deflected from the inventor originally responsible for those benefits.

World Uniformity of Testing Screens Is Badly Needed

FROM TIME TO TIME there creeps into the technical literature of the day a screen analysis followed by the letters I.M.M. This series was formulated by the Committee of Standards of the Institution of Mining and Metallurgy in 1907, the feature of the innovation being the use of wire of a diameter equal to the width of the opening. This was a novel departure, but it lacked scientific significance or economic advantage. The sponsors of the series claimed that the use of heavy wire would prevent slippage and consequent change in the dimensions of the aperture; but even this alleged advantage disappeared when it was realized that stability could easily be insured by double crimping the wires.

The disadvantages in the I.M.M. series are legion. It is obvious that a special screen must be made for use in testing sieves used in ordinary work, as sieves with apertures equaling the diameter of the wire could not find a market for commercial purposes; the screen used in milling or classifying under such conditions is different from the screen used in analysis—an obvious disadvantage. The purpose of a screen is to separate, and to do the job promptly; the unnecessary amount of dead space in many screens of the I.M.M. series is a detriment. Obviously, however, the outstanding disadvantage is the absence of any fixed ratio between one screen and the next. The Committee of Standards of the Institution should be congratulated on its initiative, and for drawing attention to the need for some acceptable series. It was unfortunate that the series decided upon suggests now what to avoid instead of what to adopt.

In 1913, Mr. G. A. Disbro, of the W. S. Tyler Company, of Cleveland, Ohio, contributed an important paper to the American Society for Testing Materials, which described the development of a screen scale of fixed-ratio openings above and below 0.0029 inch diameter—the opening of the 200-mesh sieve, as adopted by the U. S. Bureau of Standards. The apertures in the new series increased in the ratio of $\sqrt{2}$, or 1.414, the wire corforming to customary commercial screen standards and involving a minimum amount of dead space consistent with adequate mechanical strength and immovability when double crimped.

The Tyler screen series has since found wide acceptance, and the advantages gained by comparable screen analyses, with the graphic plotting of results, are being appreciated in many industries. For instance, such analyses have thrown much light on the precise particle-size requirements in the manufacture of bricks and refractories, and screen testing is being applied to great advantage in the non-metallic mineral industry, in the sand and gravel trades, in the manufacture of fertilizers and chemicals, and in the grading of such products as salt and sugar. The efficient and economical milling of metalliferous ore is dependent to a considerable extent on the efficiency of prior separation of the product into coarse and fine, as determined by preliminary screen tests, so that each particular grade is treated by the machine best adapted for the purpose. No reduction unit designed to handle granular material within a specific particle range can be expected to operate at high efficiency if the feed is contaminated with even a small amount of oversize. The value of a scientific and comparable method of screen analysis in such work cannot be overestimated.

The international acceptance of the Tyler screen series has been almost unanimous. One outstanding exception is in Australia, where strong opposition has developed against any proposal hinting that the I.M.M. series be displaced by the Tyler series. Unfortunately, no evidence is available to show even one valid reason for the determination to adhere to what is obviously obsolete and thus to postpone a standardization of result that is desired by all scientific workers.

If the I.M.M. series had anything to recommend it, world adoption would have followed as a matter of course. *Engineering and Mining Journal* favors the Tyler series primarily because it has been based on scientific principles, because it is efficient in regard to time involved in making a test, and economical because a commercial screen can be used. If sound reasons exist for the local retention of the I.M.M. series in some parts of the world, such reasons should be disclosed. Otherwise the action may be interpreted as evidence of adherence to the obsolete for sentimental reasons, thereby hindering world uniformity, inhibiting a scientific comparison of results without cumbersome interpretation, and leading to loss of time, needless confusion, unnecessary labor, and avoidable expense.

Announcement was made not long ago that a conference was planned between the Institution of Engineers of Australia and the Australasian Institute of Mining and Metallurgy; but that the council of the latter society had recommended a postponement of decision until the matter had been discussed and a recommendation made by the Institution of Mining and Metallurgy, of London. It is to be hoped that the conference will not be held in secret session, and that those who have contributed so constructively to the literature of the subject, and to the development of screen series in the United States, will have an opportunity to benefit from the arguments advanced and the decision reached.

Mining Men of Note:

SIR EDMUND DAVIS

Biographical Sketch and Interview

By GEORGE L. WALKER
London Correspondent, Engineering and Mining Journal

A DESCRIPTION of Sir Edmund Davis calls for new words and phrases. I know of no one in America or England with whom he can be compared. There may be other men who, like him, are directors of thirty-two companies; but he is an extremely interested and active director of all of them, is chairman of the board of seventeen and managing or joint managing director of twelve. He keeps in close touch with every activity of all these companies and seems to have an accurate memory of every detail. He is a director of the Anglo American Corporation of South Africa, Ltd.; African Manganese Company, Ltd. (chairman); Anglo-Continental Mines Company, Ltd. (joint managing director); British South Africa Company; Baluchistan Chrome Company, Ltd. (chairman and managing director); Bechuanaland Exploration Company, Ltd. (chairman); Bwana M'Kubwa Copper Mining Company, Ltd. (chairman); Charterland & General Exploration & Finance Company, Ltd. (chairman and joint managing director); Chinese Central Railways, Ltd.; Chinese Engineering & Mining Company, Ltd.; Chrome Company, Ltd. (chairman and managing director); Compagnie Tunisienne des Phosphates du Djebel Mdilla; Companhia de Diamantes de Angola; East African Lands & Development Company, Ltd. (joint manager); Fanti Consolidated Investment Company, Ltd. (chairman and joint managing director); Josiah Smale & Son, Ltd. (chairman); Nyassa Consolidated, Ltd.; Otavi Exploring Syndicate, Ltd. (chairman); Otavi Minen und Eisenbahn-Gesellschaft; Rhodesia Broken Hill Development Company, Ltd. (chairman and managing director); Rhodesia Chrome Mines, Ltd. (chairman and managing director); Rhodesia Copper & General Exploration & Finance Company, Ltd. (chairman); Rhodesia Railways Trust, Ltd.; Rhodesian & General Asbestos Corporation, Ltd. (chairman and managing director); Ropp Tin, Ltd. (chairman); Société d'Entreprises Industrielles et Minières; South West Africa Company, Ltd. (chairman and managing director); United Exploration Company, Ltd. (chairman); Wankie Colliery Company, Ltd. (chairman and managing director); Chinwangtao Glass Company, Ltd.; Loangwa Concessions (Northern Rhodesia), Ltd. (chairman and managing director); and Shabanie Railway Company, Ltd.

SIR EDMUND DAVIS

The career of such a remarkable man cannot fail to be interesting, but can be merely touched upon. He went to South Africa in 1879, was employed by a commercial firm, and soon took over the management of sealing and guano islands near the coast. Going to Barberton, he acquired an interest in a gold-mining company there, and afterward went through South West Africa. Returning to London, he floated the Bechuanaland Exploration Company, Ltd., the activities of which reached into Rhodesia. He formed various companies to work minerals in Southern Rhodesia, and later the companies that started operations

in Northern Rhodesia. He organized Bwana M'Kubwa and also Rhodesia Broken Hill, since then directing the affairs of both companies and finding the money for development and equipment. In the early days of Rhodesian development he took up chrome mining, and gradually obtained a place in the world's markets for Rhodesian chrome ore, where it now has a commanding position. He also interested himself in Rhodesian asbestos mining; and, after two or three reconstructions of companies, is now chairman and managing director of the Rhodesian & General Asbestos Corporation, Ltd., one of the most successful asbestos concerns in the world. Another of his creations is the Wankie Colliery Company, Ltd. It produces about the best coal mined in South Africa, supplies the Rhodesias and also the bulk of the fuel requirements of the Katanga group of mines. As will be noted, Sir Edmund has been called to the directorates of many other large companies than those of his own creation. Last year he was knighted by King George in recognition of his work in developing the mineral resources of the British Empire. Sir Edmund has an astonishing capacity for work, and also remarkable administrative ability. He is a dependable optimist, as his spirit is never crushed by disappointment. If a promotion proves unfortunate he stays with it until he finds a way to make it successful. His mental resourcefulness seems unlimited, and his tenacity of purpose never wavers. With all his vast interests he finds time for rest and for play; he is always genial, never flustered, and never shows signs of being overworked.

I asked Sir Edmund Davis for his opinion of the mineral resources of the Rhodesias. The following is his reply:

"Though it is somewhat difficult to know where to commence when called upon to give my opinion of the mineral resources of the two Rhodesias, in the development of which I am so much interested, it may be better to start with Southern Rhodesia than with its sister colony on the other side of the Zambesi.

"It is apparently the custom, or should I say the habit, for mineral discoveries in South Africa to assume a dominative position in the world. The gold industry established on the Witwatersrand and the production of diamonds in many fields attest to this.

"In Southern Rhodesia certain areas were found to be honeycombed with old workings, evidence of gold mining activities by unknown ancients. Yet gold has not been produced there on anything like the scale anticipated by the pioneers who first entered the territory. It is in other metals and minerals that Southern Rhodesia is taking the leadership.

"There are important deposits of chrome ore. These are located along what is known as the Dyke, the dyke which has a northeast and southwest length of over 500 miles. There are one or two separate locations outside this, Selukwe Peak being by far the most important. Up to Sept. 30, 1927, Selukwe had produced 1,200,000 tons of Rhodesia's total output of 1,590,000 tons. In the course of time Rhodesia should be the only producer of chrome on a large scale, as the demand is steadily increasing and no other discoveries of chrome ore are being made.

"The chrome ore on the Dyke is very patchy, so far as the width of the deposit is concerned, and in depth will be expensive to mine. There are no large deposits on the Dyke, such as the Selukwe, the formation of the former being comparable to ordinary reef.

"Coal is being worked in Southern Rhodesia at only one spot—namely, Wankie. Huge tonnages have already been proved there. On one area alone, covering 400 square miles, sufficient coal has been disclosed to supply Southern Rhodesia and the Katanga at the present rate of consumption for the next 4,000 years.

"An outstanding proposition in Southern Rhodesia is the group of asbestos producing mines belonging to the Rhodesian & General Asbestos Corporation, Ltd. In these is included the Shabanie, which is considered to be the richest asbestos mining property in the world. Those in control of the railways are so well satisfied with the importance and future of Shabanie that a branch of 62 miles from the main line has lately been constructed and opened.

"Leaving Southern Rhodesia and going north we come first to Broken Hill. Here an area of 35 square miles is owned by the Rhodesia Broken Hill Development Company, Ltd. Lead-zinc ore is being mined on a fairly large scale, though the electrolytic zinc plant only started operating early this year. Those in control are so impressed with the future of the small portion of the property so far opened up that not only have they already harnessed 12,500 hp. at Mulungushi, about 39 miles from the mine, but are investigating other water-power sources.

"The present rate of output should gradually increase to about 18,000 tons of electrolytic zinc and 4,000 tons of lead per annum from the ore deposits now being mined. This should be considered a fair output from a new industry which is in its initial stage and has been created about 1,350 miles from a port.

"Farther north in Northern Rhodesia are the properties of the Bwana M'Kubwa Copper Mining Company, Ltd., these including the N'Kana, which may at no distant date prove to be one of the biggest copper mines in the world. Were this one mine, the N'Kana, capitalized and dealt with in the United States, the value placed upon it now by the British public would appear low, or perhaps ridiculous, as that of the American equipped propositions work out roughly at £370 per ton of copper produced per annum.

"Bwana M'Kubwa is producing copper from the oxidized section of the ores from its Bwana mine and proving its N'Kana property by drilling. N'Kana boreholes completed to the end of the June quarter had indicated 13,400,000 tons of ore averaging 4½ per cent copper, of which 10,000,000 tons is clean sulphide, the balance mixed oxide and sulphide. This tonnage was embraced in the small area which had then been drilled—namely, 5,700 ft. along the strike and to a vertical depth of 800 ft., the orebody dipping 40 deg. and having an average true width of 25 ft. Since then the drills have further proved the deposit to a length of 7,500 ft., and deeper holes are being drilled. The deepest so far completed was in ore from 1,130 to 1,167.5 ft., which averaged 5.1 per cent, though the true width of the orebody in this particular hole was 26 ft. and the average 5.03 per cent.

"It may be interesting to mention that on the northern end one of the boreholes was sunk about 1,000 ft. beyond the known outcrop, and at a depth of 216.5 ft. revealed 16.4 ft. of ore assaying 4.58 per cent copper. Farther south, at a point where space intervenes between outcrops, a borehole struck, at 535 ft. of depth, 31 ft. true width of ore averaging 4.33 per cent copper.

"What the full length of the N'Kana deposit is has not been determined. It has not yet been drilled over a length of more than 7,500 ft. There is such evidence of its continuance that mineral rights have already been secured over two blocks of 10 square miles to cover extension of strike. The company has the privilege now of taking up 42½ additional square miles of mineral rights, making a total of 62½ square miles for the N'Kana property, so the ore deposit is protected in both strike and depth. A railway to this mine should be completed next year.

"In addition to its Bwana and N'Kana mining groups, Bwana M'Kubwa Copper Mining Company, Ltd., holds a 33 per cent interest in any property to be marked out on what is known as the N'Kana grant, an area of 1,800 square miles, till October, 1929, and thereafter a 65 per cent interest in properties taken up to April 30, 1935.

"What is of great interest, aside from the high copper content of the deposits being developed, is the nature of the formation in which they occur. The formation is so similar to coal measures that the tonnage possibilities are far in excess of anything one might imagine at the moment. One following the developments is led to believe that these discoveries in Northern Rhodesia may possibly, within the next twenty years, have followed the example set by other mining industries of South Africa, giving the southern portion of

that great continent, in addition to the largest gold, diamond, chrome, and asbestos mines, the greatest group of copper mines in the world.

"Leaving these individual propositions, I will speak of the policy adopted by the British South Africa Company, and of the results. The policy is that of hastening the development of the mineral resources of Northern Rhodesia by making large, exclusive prospecting grants to groups capable of finding the necessary technical staffs and of providing the capital required to develop such minerals of value as may be found.

"Originally, which is only a short time ago, extensive grants were made to the following companies:

"Rhodesian Congo Border Concession, Ltd.

"Serenje Concessions, Ltd.

"Kasempa Concessions, Ltd.

"Loangwa Concessions (Northern Rhodesia), Ltd.

"Rhodesia Minerals Concessions, Ltd.

"These companies have been encouraged in the valuable work they are doing by having their areas or the time-length of their grants extended. Of their discoveries of previously unknown mineral deposits the N'Changa copper property is developing favorably, giving promise of becoming an important producer.

"The expenditure of a fair amount of capital having shown the advisability of concentrating work in particular areas, and of reducing overhead charges, the Loangwa Concessions, Ltd., became the owner, in addition to its own prospecting rights, of those held by the Serenje Concessions, Ltd., and the Kasempa Concessions, Ltd., the company then being provided with £500,000 more working capital.

"The staff at present employed by Loangwa is by far the largest and best equipped yet brought together by private interests for a geological survey. It is, in fact, exceeded in size by the geological staffs of only one or two governments, one of which is the United States. There are 21 parties permanently in the field, making regular monthly reports to headquarters. After such reports are considered, instructions are given as to further prospecting. The organization is so thorough that every square yard of Loangwa's territory, some 85,000 square miles, should eventually have come under actual visual observation.

"There are already satisfactory evidences that part of this area is underlain by sediments of the N'Kana series, which include the orebodies being developed in the Roan Antelope and N'Kana mines, though of course it is at present impossible to say whether anything of value will be found in this formation where it occurs in this ground. Indications of various minerals, including gold, have been found in various parts of the territory, and in the course of time it is reasonable to suppose that valuable discoveries will be made."

Electrolytic Zinc Plant Costs

DECISION was recently reached by the Evans-Wallower Lead Company to erect a 50-ton electrolytic zinc plant at East St. Louis, Ill., in which the Tainton process, recently developed at the Sullivan plant at Kellogg, Idaho, will be used. Construction has already started. The company has a contract giving it the exclusive right to use the Tainton process in the states of Missouri, Kansas, Oklahoma, and Arkansas, provided a gradually expanding production, as regulated by the terms of the contract, is made during the next seven years. The raw material will be flotation concentrates, secured from the complex-ore concentrating plants of the Western states. The principal product is expected to be zinc of 99.99 per cent purity, with lead, cadmium, manganese dioxide, and sulphur gas as byproducts.

Plans and estimates were made by F. E. Pierce, of 461 Eighth Ave., New York City, and J. H. Gillis. Based on preliminary bids costs of this 50-ton plant are:

	Total	Per Cent of Total
Electrical equipment	$104,000	13.4
Tanks and machinery	241,000	31.1
Metals	112,000	14.4
Steel	75,000	9.6
Building materials	125,000	16.1
Labor	105,000	13.5
Freight and miscellaneous	13,000	1.9
Totals	$775,000	100.0

To this is added $25,000 for contingencies, making the total estimated cost of the plant $800,000. Other estimated expenses will be as follows:

Rental of roasting plant	$6,000
Engineering and supervision	40,000
Possible cost of power lines	40,000
Insurance and damage claims	17,000
Interest during construction	50,000
Company overhead	12,000
Consulting engineering and traveling expenses	23,000
Cost of land	12,000
Total	$200,000

This would make the cost of the entire project an even million dollars, though it is expected that $100,000 of this amount can be saved through lower prices obtained in competitive bidding. Receipts from stock sales are expected to be $1,250,000, leaving a good working capital.

Mr. Pierce expects the net annual earnings after all charges, including federal taxes, to be about $860,000.

Electric Power and Economical Mining

ELECTRICITY must be accepted as a suitable form of power for underground hoisting, air compressing, pumping, haulage, ventilation, crushing, lighting, and for many other purposes. Improved ventilation is receiving major attention. In a paper to appear soon, read before the A.S.M.E. recently, Mr. A. C. Butterworth, electrical engineer of the mining department of Pickands, Mather & Company, refers to a conclusion reached by underground workers about a fan—as "worth a million dollars." Lighting, too, could be improved in many mines. Electric shovels are being adopted widely, especially on open-cut properties. Electric tramming has proved its worth in many mines. The general replacement of all other forms of power machines by electrical equipment is not an accomplished fact, however. "The success of further extensions in the use of electric power," says Mr. Butterworth, "either to increase mining efficiency or to decrease operating hazards, will depend to a considerable extent on whether satisfactory equipment can be provided and operated at a cost that will let it compete with present methods of mining." He was referring more particularly to the Lake Superior regions notable for the production of iron.

Discovery-Depletion Clause of 1928 Revenue Act Needs Revision

By GRANVILLE S. BORDEN
Mining Engineer, San Francisco

THE rule is well substantiated by court decisions that an income-tax payer has no right to deduct anything from the proceeds of a mine on account of the depletion of the mine. The taxpayer's rights accrue to him solely by virtue of the statute under which the tax is assessed. Assume that a taxpayer owns, in a stope, ore in place having a fair market value of $100,000. He mines, hoists, and sells the crude ore for $150,000. In the absence of specific provisions in the income-tax law for depletion, the income tax would be based on an income of $150,000 less the cost of mining, hoisting, and selling the ore. The right to deduct anything on account of the loss sustained by reason of the exhaustion of the capital value of $100,000 as an incident to the derivation of $150,000 gross income must be found in the taxing act.

Mine operators, owners of mining royalty rights, and stockholders in corporations that derive income from the exhausting of minerals or from mining royalties have an interest in those depletion provisions of Title I of the Federal Revenue Act of 1928 that concern the income tax. One of the deductions from gross income allowed by the act in the computation of net income is a deduction entitled "depletion." Section 23 is quoted in part as follows:

"In computing net income there shall be allowed as deductions:

"(1) Depletion—In the case of mines, oil and gas wells, other natural deposits and timber, a reasonable allowance for depletion and for depreciation of improvements, according to the peculiar conditions in each case; such reasonable allowance in all cases to be made under rules and regulations to be prescribed by the Commissioner, with the approval of the Secretary. In the case of leases the deduction shall be equitably apportioned between the lessor and lessee."

Section 114 (*b*) is entitled "Basis for Depletion." The provisions in the first paragraph under sub-section 114 (*b*) may be summarized briefly as follows: If acquired prior to March 1, 1913, the basis shall be the cost of the property, or the fair market value on that date, whichever is greater. If acquired after March 1, 1913, the basis shall be the cost of the property; except that, if acquired through bequest, devise, inheritance, gift, reorganization, merger or liquidation, other provisions apply, which cannot be discussed in this article.

The second paragraph under sub-section 114 (*b*), which will be referred to as the "discovery-depletion clauses," provides for a depletion base in lieu of the general rule stated above under certain conditions and circumstances. The purpose of Congress in inserting this clause in the law may be reasonably presumed to have been to reward taxpayers who have added additional proved natural resources to the nation's wealth as a result of the risking of personal funds. The paragraph is as follows:

"(2) Discovery value in case of mines—In the case of mines discovered by the taxpayer after February 28, 1913, the basis for depletion shall be the fair market value of the property at the date of discovery or within thirty days thereafter, if such mines were not acquired as the result of purchase of a proven tract or lease, and if the fair market value of the property is materially disproportionate to the cost. The depletion allowance based on discovery value provided in this paragraph shall not exceed 50 per centum of the net income of the taxpayer (computed without allowance for depletion) from the property upon which the discovery was made, except that in no case shall the depletion allowance be less that it would be if computed without reference to discovery value. Discoveries shall include minerals in commercial quantities contained within a vein or deposit discovered in an existing mine or mining tract by the taxpayer after February 28, 1913, if the vein or deposit thus discovered was not merely the uninterrupted extension of a continuing commercial vein or deposit already known to exist, and if the discovered minerals are of sufficient value and quantity that they could be separately mined and marketed at a profit."

The deductions for any taxable period on account of depletion are computed by dividing the amount of recoverable cost, or value at the beginning of the taxable period, by the estimated number of units (such as tons or cubic yards) in the reserves at the beginning of the taxable period, and by multiplying the quotient by the number of units exploited during the taxable period.

From the foregoing it is clear that the income-tax liability varies inversely as the depletion allowances; the depletion allowances vary directly with the recoverable values or cost; and the recoverable values depend on: (1) whether discovery-depletion is or is not allowable, and (2) the value of the discovered deposit on the date of discovery or thirty days thereafter.

To illustrate the effect of discovery-depletion upon the

tax liability the following hypothetical case is presented:

A mining corporation, believing there was a reasonable chance to develop an orebody on a certain claim, purchased the claim for $50,000. Exploration proved the existence of an orebody having a fair market value of $500,000. A reasonable estimate of the ore reserves was 50,000 tons. The government centends that the property was a "proven tract" at the date of acquisition and bases depletion on a cost of $1 per ton ($50,000 divided by 50,000 tons). The taxpayer claims the property was not a "proven tract" at the date of acquisition and claims depletion on discovery value at a rate of $10 per ton mined ($500,000 divided by 50,000 tons). In one taxable year 10,000 tons is mined, yielding $120,000 net income before depletion. If the government's contentions are correct, the taxable income would be $120,000, less depletion of $10,000 ($1 per ton x 10,000 tons), or $110,000. The tax at 12 per cent would be $13,200. If the taxpayer's contentions are correct the taxable income would be $120,000, less depletion of $60,000 ($10 per ton x 10,000 tons is greater than 50 per cent of $120,000), or $60,000. The tax at 12 per cent would be $7,200. The difference in tax liability, depending on whether or no the property was a "proven tract" at acquisition, would be $6,000.

As the provisions and interpretations of this discovery-depletion clause in the law may affect the income-tax liability of many recipients of profits, royalties, or dividends from mines, it is proper for the interested parties to make the following inquiries:

Does the discovery-depletion clause accomplish the purpose for which it was inserted in the law? Can the law be administered so as to afford the benefits to the parties entitled to the benefits within the purview of the intention of Congress? Is proof of facts and circumstance prerequisite to the allowance of discovery-depletion an onerous burden on taxpayers seeking discovery-depletion benefits? What issues may arise and stand between the taxpayer and the government to deter or bar the allowance of discovery depletion? Is there need for revision of the discovery-depletion clause? If so, how should the clause be amended, and what can a taxpayer do to assist in having the clause amended? In the following paragraphs these questions will be discussed.

Segregating from this discovery-depletion clause the statutory prerequisites to discovery-depletion benefits, the following may be stated:

A "mine" must be discovered; the mine must be discovered "by the taxpayer"; discovery-depletion cannot be allowed with respect to a mine that was acquired by a taxpayer "as the result of the purchase of a proven tract or lease"; the fair market value on the date of discovery or thirty days thereafter must be "materially disproportionate to the cost"; the discovered deposit cannot be the "uninterrupted extension of a continuing commercial vein or deposit; the discovered minerals must be of sufficient value and quantity that they could be separately mined and marketed at a profit."

If one assume that the intention of Congress in inserting the discovery-depletion clause in the law was to reward those who hazard capital in prospecting and exploring and, as a result, add natural resources to the nation's wealth, and if one then consider the strict prerequisites contained in the act affecting the allowance of the benefits, it will be clear that only a small minority of those that Congress intended should participate do actually derive any benefit from the discovery-depletion clause.

The coal and non-metal industries seldom, if ever, share in the benefits of the discovery-depletion clause. No doubt numerous coal and non-metal deposits are discovered by taxpayers, but the discoveries cannot meet the strict statutory prerequisite, because the deposits are usually extensions of deposits previously known to exist, or because a "quarry" is not a "mine," and the statute allows discovery only "in the case of mines."

A metal miner working on a dipping vein, who sinks his vertical shaft depeer, crosscuts, and discovers that the vein continues in depth cannot benefit from discovery-depletion, because the situation does not meet the prerequisites contained in the statute. This taxpayer may risk a sum considerably more than does the metal miner who discovers, by drilling 300-ft. holes, that a deposit is separated, from one upon which he has previously been working, by a 15-ft. wall of limestone. Both taxpayers would add new natural resources to the nation's wealth, but only one of the taxpayers would be entitled to the benefits of discovery-depletion. The taxpayer who risks his money to discover numerous small recurring oreshoots in a limestone lode, a fissure quartz vein, or other formation, cannot have the benefits of discovery-depletion on any of these deposits that cannot be mined and marketed commercially as separate mines. Numerous other examples could be stated to show how this law works inequities when it is administered according to its terms.

Another fault in the discovery-depletion clause is the difficulty of administering the law. A taxpayer claiming depletion based on discovery value must prove the existence of every condition precedent to the right. Sometimes documentary evidence is inadequate. Sometimes, parol testimony will be required. Valuations, maps, and accounts must be prepared and submitted to the department. The bureau engineers may examine the property.

In numerous instances controversies arise, and conferences in Washington are necessary. It may also be necessary to carry the issue of a right to the discovery-depletion base, or the issue respecting the amount of the value, to the United States Board of Tax Appeals or the federal courts. The final determination of the tax liability is delayed indefinitely.

This discovery-depletion clause is a fertile source of administrative and judicial controversies. Some of the issues that arise over the question of rights to discovery-depletion, and the amount allowable, are as follows:

1. The law provides that the discovery shall be made "by the taxpayer." A lessor contends that he has contributed sufficiently to the discovery actually drilled out by the lessee because he granted a wildcat lease at a much lower royalty rate than if the discovery had been made. The bureau may take the position that the contribution of the lessor is not adequate to bring him within the prerequisite of the law and thus bar him from the benefit of the law.

2. A taxpayer may claim that a discovery is not consummated until development has demonstrated the full economic possibilities of the deposit, and the valuation should be deferred until that time. On the other hand, the bureau may allege that the discovery is consummated as soon as the value has been proved to be materially in

excess of the cost. The law or the regulations do not prescribe a rule or guide for ascertaining when the discovery is complete. The date cannot be prior to a time when the value has been demonstrated to be materially in excess of the cost, but the law does not state an ultimate date beyond which the discovery can be deferred.

3. A condition precedent to discovery benefits is that "the mine cannot be acquired as the result of the purchase of a proven tract or lease." A taxpayer under an ordinary lease and option discovers an orebody and buys the mine. He claims discovery and alleges that it was acquired as an unproved tract. The bureau alleges that at the time the option was exercised and the mine purchased, the mine was a proved tract, and therefore not entitled to discovery benefits.

4. The law provides that a discovery can be allowed only when the new deposit is not "an uninterrupted extension of a continuing commercial vein or deposit already known to exist." As of what date should this test be applied? Suppose a taxpayer discovers a deposit, but no one knows if it is connected with another known deposit? If discovery is granted and later it proves to meet the conditions of the statutory bar, what happens? Suppose discovery is denied, and later development proves that it is a separate orebody; what happens? In the meantime the statute of limitations against additional assessments or refunds may have run.

5. A condition for the allowance of discovery benefits is that the fair market value of the discovered deposit must be *materially* in excess of the *cost*. Who is to define the percentage involved in the word "materially"? Does materially mean 1 per cent above cost or 300 per cent? What "cost" is meant in this prerequisite in the case of leases? Is it the cost to the operator of the lease, or does it include the cost of all equities and does it include all development costs?

6. Is a taxpayer entitled to discovery benefits on a deposit he knew was in existence at the date of acquisition, but which became a commercial deposit after acquisition through the application by the taxpayer of mining, milling, transportation, or marketing economies?

7. A discovery cannot be allowed if the mine has been acquired by the taxpayer as the result of the purchase of a proved tract or lease. By what standard, rule, or guide can one determine if the mine was a proved tract or lease on the date of purchase? Explorations are usually prosecuted because there is some geological clew that ore exists at the destination of the drill hole, drift, or other exploratory working. Who will place a percentage on the probability of finding a mine as result of the search, so that if the percentage of probability be higher than the fixed percentage, no discovery is allowable, and if it be below, the discovery is barred?

8. What is a "mine"? Congress has extended the benefits of the discovery-depletion to "mines." Sand and gravel pits, cement rock deposits, borax deposits—are these "mines" in the eyes of the law?

9. In ascertaining if "discovered minerals are of sufficient value and quantity that they could be separately mined and marketed at a profit," can the taxpayer have the advantage of considering the means of entry to the deposit through existing development, or is it necessary to apply the test as though the deposit were isolated?

The foregoing issues relate merely to issues over the right to the discovery-depletion base. In addition to these, controversies may arise over all the factors which have a tendency to influence the valuations. Some of them are: The estimated reserves and grades; estimated sales price per unit; estimated operating costs per unit; estimated discount, method of discount, formula to apply, discount rates, safe hazard, application of hazard rate; the estimated life of the discovered deposit involving estimated rate of exploitation; the estimated tangible property and development to be consumed in winning the profits; estimated deferment before operations start.

If this clause remain in the law it is reasonable to assume that many of these issues will be the subject matter of expensive litigation before the Board of Tax Appeals and the federal courts. From the foregoing it is clear that some of these questions would be difficult to answer, even for one who has extensive geological and mining knowledge.

If the point has been established that the present mine discovery-depletion clause contained in Article 114 *(b)* (2) of the Revenue Act of 1928 will lead to inequitable settlements; that it will be difficult to administer; that it will be the source of hardship, expense, and litigation to the mining taxpayers interested in it, the next question is: What is the remedy?

One remedy, open for consideration, is by an amendment at the next session of Congress to supersede Section 114 (*a*)(2) and in lieu thereof to substitute a provision similar to Section 114 (*b*) (3) which applies to the oil industry. Section 114 *(b)* (3) is as follows:

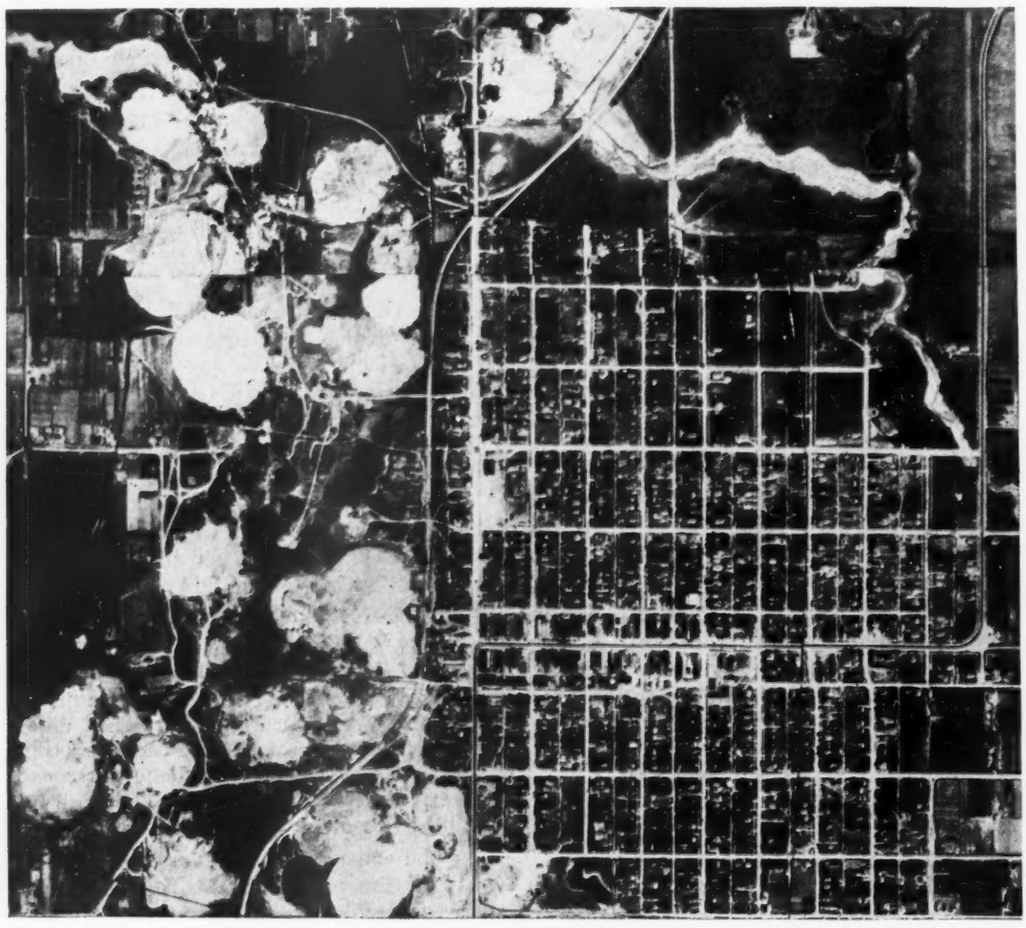
"(3) Percentage depletion for oil and gas wells.—In the case of oil and gas wells the allowance for depletion shall be 27½ per centum of the gross income from the property during the taxable year. Such allowance shall not exceed 50 per centum of the net income of the taxpayer (computed without allowance for depletion) from the property, except that in no case shall the depletion allowance be less than it would be if computed without reference to this paragraph."

By the enactment of a similar provision, most of the faults of the present clause can be remedied. An unsuccessful effort was made at the last session of Congress to supply this remedy. It is my understanding that another effort will be made at the next session.

The scope of this article does not make practicable any suggestion as to the percentage of income that should be applied as depletion deduction in the case of mines. This question was a difficult one for those who were endeavoring to amend the discovery-depletion clause at the last session of Congress. The problem presented seems to be one which demands co-operative effort to the end: first, for the determination of a basis to supersede the present alleged unsatisfactory basis; and, second, for the presentation of the problem and presentation of the desires of the mining industries to the proper Congressional committees.

TWO more instalments remain to be published of the series of articles "Revisiting Arizona Mining Camps," by E. H. Robie, though both of these deal with operations just beyond the Arizona state line. Brief comments on the Chino mill of Nevada Consolidated will appear in an early issue, followed by a short description of recent activities at the El Paso smelter.

Aërial Photographic Mosaic



Towns are usually built up in proximity to developed ore deposits, as is evident in this view of Commerce, Okla.

By H. I. SMITH

Chief Mining Supervisor, Conservation Branch, U. S. Geological Survey, Washington, D. C.

AN AËRIAL photographic mosaic of the Oklahoma section of the Tri-State district, completed recently, has been of increasing value to the Office of Indian Affairs and the Geological Survey in supervising lead- and zinc-mining leases in the Quapaw Indian Reservation. It is also of considerable benefit to departmental lessees and to numerous other agencies interested in that district. This mosaic was made by the Department of the Interior in co-operation with the War Department and the Chamber of Commerce of Picher, Okla.

Perhaps the most unusual purpose for which the mosaic has been used is in relocating "lost" drill holes and in determining the extent to which certain tracts have been prospected by drilling. The position of each hole now drilled is accurately determined by the usual survey methods and recorded. For thousands of holes drilled in the past, however, records either were not kept or have been lost.

On some occasions the individuals or the groups holding options on different tracts, drillers and others prospecting during periods of a slack metal market, and interests testing outlying parts of the district with the intention of later obtaining mining rights thereto should ore be encountered, kept no drill logs and made no permanent record of the position of the holes drilled. Any attempt to determine the position of these drill holes seemed to be a hopeless undertaking, until it was observed from an airplane traveling above the district that the sludge piles, or cuttings, dumped from the bailer

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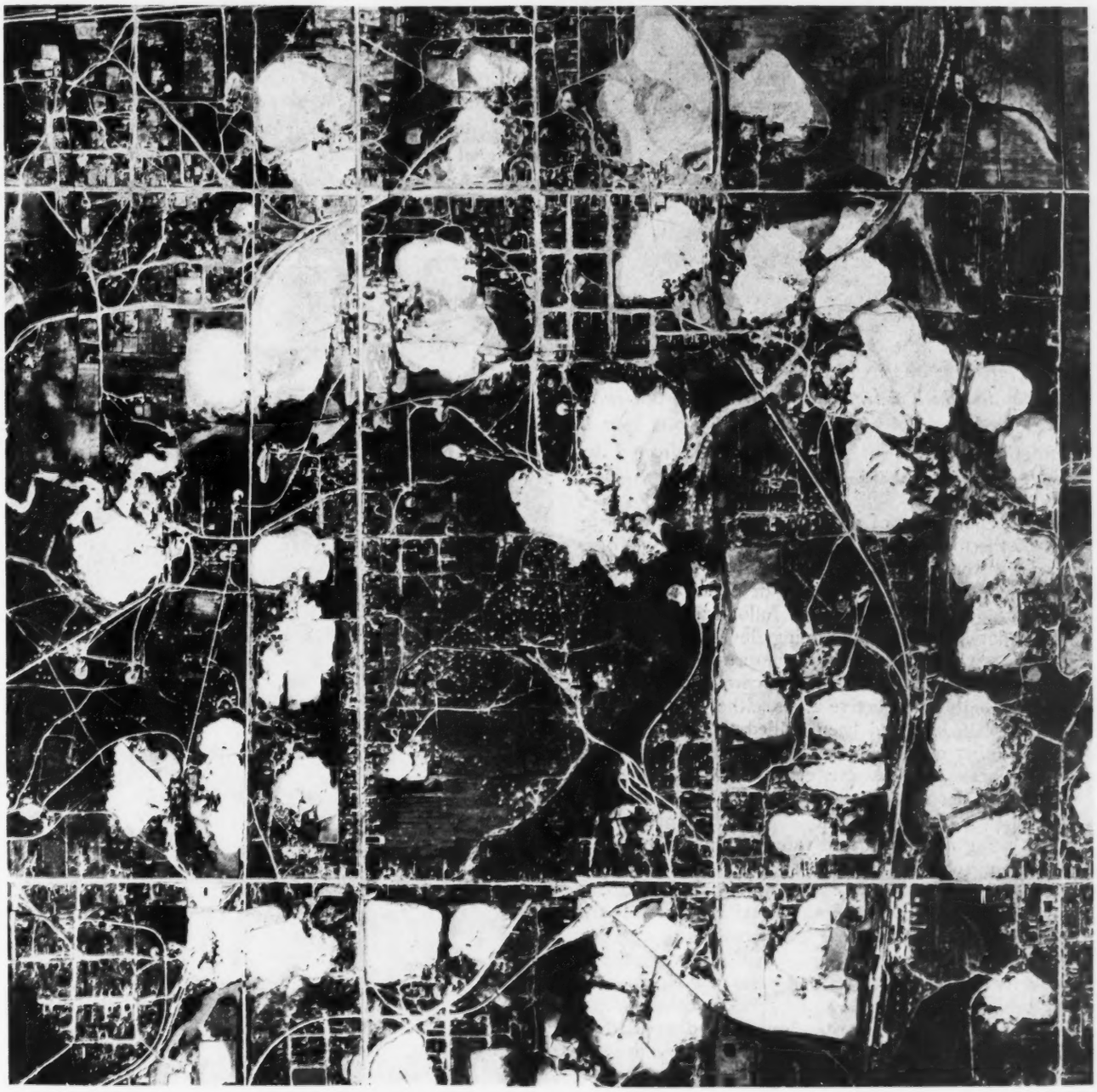
Solves Many Problems

In the Tri-State District

in the course of drilling the holes were clearly visible as white dots on the ground, even in sections where there was considerable vegetation. This observation led to the conclusion that the position of many of the "lost" holes could be accurately ascertained from aërial photographs, and that an aërial mosaic of the district on the scale of 1 to 10,000 would be invaluable in determining the extent to which different areas had been prospected by drilling.

Highways, railroads, and creeks are frequently obstructions to the economical location of mills, chat piles, and other surface plant at the mines. This is evident in the illustration shown below, which includes the southern portion of the city of Picher, Okla., and the city of Century, Okla.



The extent to which a tract has been drilled is clearly indicated by the aerial photograph. Each white spot is a photographic record of a drilled hole indicated by sludge dumped from the bailer in the course of drilling.

After the completion of the aërial survey and the preparation of the mosaic, one of the most striking features observed was that the drill holes in many areas had been placed very unsystematically. No definite program of prospecting appeared to have been followed, and only in the areas that had been undergoing development in the last few years was a trend toward pattern drilling noticeable. The mosaic also showed that certain tracts, near or adjoining highly productive areas, either had not been thoroughly drilled or had been drilled to only a minor extent. In other close-in areas there was no evidence of drilling. These features are clearly indicated in the accompanying illustrations.

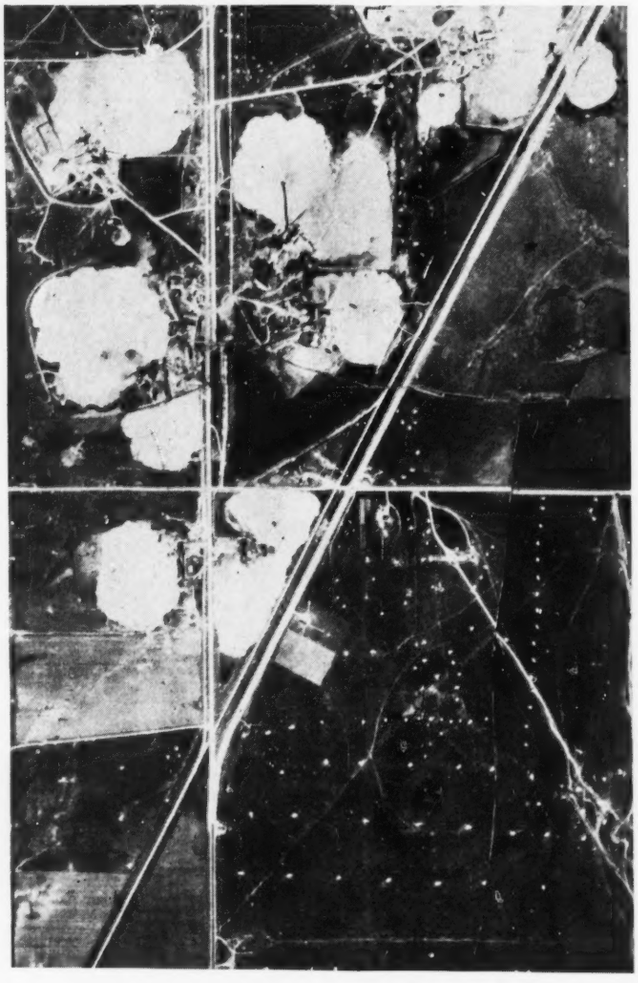
Besides being of inestimable value in connection with discovering unrecorded drill holes and as a guide in prospecting, the mosaic assists greatly in finding areas that may be used for the disposal of tailings. Many of the chat piles in the district are being remilled as a result of improved milling practice, and additional space must be found for the disposal of the re-treated tailings. As buildings, highways, railroads, and creeks surround the mill sites on a number of properties in the district, this situation presents a serious problem. A few minutes spent in studying the mosaic invariably leads to the most satisfactory solution, and avoids the expense and time of considerable surveying that would otherwise be required in preparing a map of the area. Moreover, such a map would not contain the mass of detail recorded by the aërial photographs, which is of extreme value in studying the problems noted.

In the heart of the Oklahoma section of the Tri-State lead-zinc district, chat piles, mills, dwellings, highways, railroads, and natural watercourses crowd each other, and an aërial photographic mosaic aids materially in determining the rights of each to space in the district. As the chat piles are remilled new areas must be allotted for the disposal of re-treated tailings.

In the preparation of other maps of the district the aërial survey has been of considerable value. Recently the State of Oklahoma detailed a corps of engineers to re-map the area photographed. With the aid of the mosaic the task was accomplished in much less time than would otherwise have been required.

Although copies of the aërial mosaic, or parts of it, are not available for distribution to the public, anyone interested may consult a copy at the offices of the Geological Survey at Miami, Okla., or Washington, D. C.

When the operator of the property in the triangle formed by the railroad and two highways made application for additional land on which to dispose of mill tailings, this view showed conclusively his necessity for such facilities. A tendency toward regular spacing of drill holes to prospect an entire tract is seen in the area to the right.



A System of Subsidiary Mine Drainage

By R. P. Hooper

UNDERGROUND mine drainage may be conveniently divided into two operations—(*a*) collecting and transporting drainage water to the pump cistern, and (*b*) elevating water to the surface by pumping. Operation *(b)* does not come under the heading of subsidiary mine drainage.

This paper describes a system which automatically performs operation (*a*), and which has been developed on the South mine, at Broken Hill, under the supervision of F. McDonell, the mine foreman. It has the following feature: (1) All drainage waters are collected by gravity flow into sumps; (2) automatic control boxes operate siphons, which transfer water from level to level to pump cisterns or to feed-water service.

Equipment

The siphon-control box is constructed of 10x2 ft. Oregon timber, suitably bolted together and equipped with a Bailey's cistern valve, with copper-ball float control, and 1½ in. pipes and fittings forming a siphon (Fig. 1). One of these boxes is placed on each level at the shaft. In Fig. 1, all bolts are 2 ft. 10 in. x ½ in., screwed each end. Washers are 2 in. x 2x⅛ in. and pipe fittings are 1½ in.

The valve and float are so arranged that when the float is up (and the box full) the valve will be fully open; and when the float is down (and the box empty) the valve is closed. The vertical range between the extreme positions can be altered by lengthening or shortening the adjustable arm of the float. An ideal valve is one that will, as the float is rising, remain closed until near the end of the movement, and then quickly open to give full-bore discharge of the siphon. Then as the float falls the valve will remain open till near the end of the movement and then quickly close and seal the siphon. For a time a plug valve was used, but owing to excessive friction, and as it did not fulfill the foregoing qualifications, it is being replaced by the Bailey cistern valve. The sump siphons are shown in Fig. 2.

A 1½-in. outlet pipe from the control box connects to a 2-in. down pipe to No. 2 level below. In addition, all sumps are connected by 1½-in. pipes to the same 2-in. pipe; where convenient, two or more sumps can be connected with the one 1½-in. pipe. At each sump, at the end of the 1½-in. suction pipe, is a valve or a valve with a float control; or, in some instances, the pipe is left open. The valves used at present are of the same type as used in control boxes. The distance from the highest point in the pipe system to the lowest water level should not exceed 27 ft.

Very deep sumps do not need control valves, because the water will siphon until the force of gravity stops it —the end of the pipe still being some distance under water.

At a convenient distance down the shaft (usually about 16 to 20 ft.) there is a loop in the 2-in. main, made from elbows, sockets, and short lengths of 2-in. pipe. This is about 9 ft. high and 2 ft. wide, but these dimensions vary within wide limits. A plugged T piece at the bottom of the loop gives access when cleaning is necessary. From the down pipe to the top of the loop is a ⅜-in. or ½-in. connection. This prevents air locks.

The 2-in. down pipe ends over the No. 2 control box, where the rate of discharge is regulated by a valve or by a short length of smaller pipe screwed to the main. If it is required to divert drainage water into the feed-water cistern, a 1-in. or 1½-in. connection is made to the down pipe. Each successive level is equipped with the same pipe system in the shaft, but of necessity the siphoning pipes to the sumps will vary according to local conditions on each level. The final 2-in. down pipe discharges into an open drain leading to, or directly connected with, the cistern on the pump level.

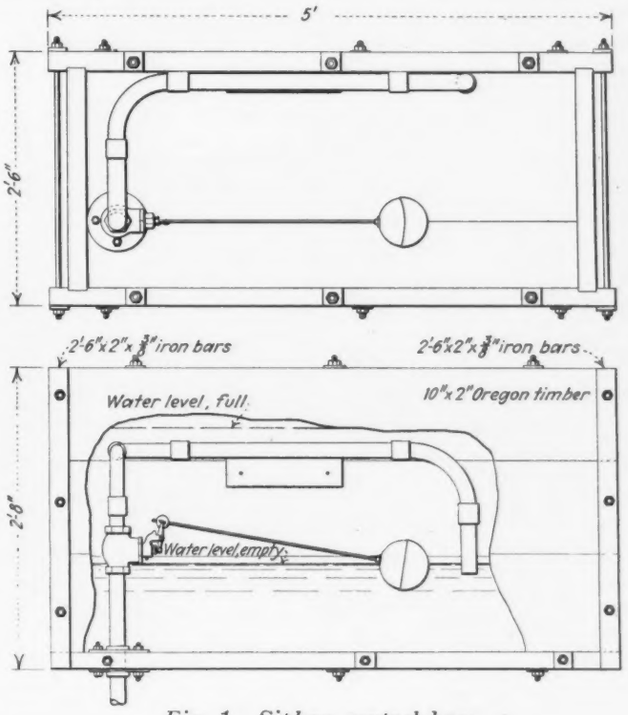


Fig. 1—Siphon control box

Operation of the System

Drainage waters, both natural water and that derived from mining operations, are collected by gravity flow through drains, or pipes, into sumps at convenient points on each level. These sumps are holes about 7x5x8 ft. deep—in the bottoms of the levels, or wooden or concrete boxes. The latter receive drainage water from winze bailing operations; from water rings in shafts or passes; from diamond-drill holes; or from other sources.

It must be remembered that at each sump or box, although the inflow is continuous, the necessity for removing accumulated water occurs only at intervals.

As little direct drainage flows into the control boxes on each level, the operation of the system depends, to a great degree, on the regularity of discharge of the top-level control box. Study and adjustment are necessary before regular operation of the system can be obtained.

In operating a control box it is essential to have a comparatively quick filling of the last few inches, to

Abstracted from the *Proceedings* of the Australasian Institute of Mining and Metallurgy.

insure a full-bore discharge. Although local drainage water may be sufficient to operate the box at the required interval, the slight opening of the valve, as the float rises, may give an outflow sufficient to balance the drainage inflow; then the float will remain stationary and the siphon will not act with enough volume to start the sump siphon. This difficulty can be overcome as follows:

1. Add more water from a 1-in. branch from the feed-water main in the shaft. This quantity is regulated by a valve. The extra water cannot be counted as lost, or as a cost against the system, because a portion

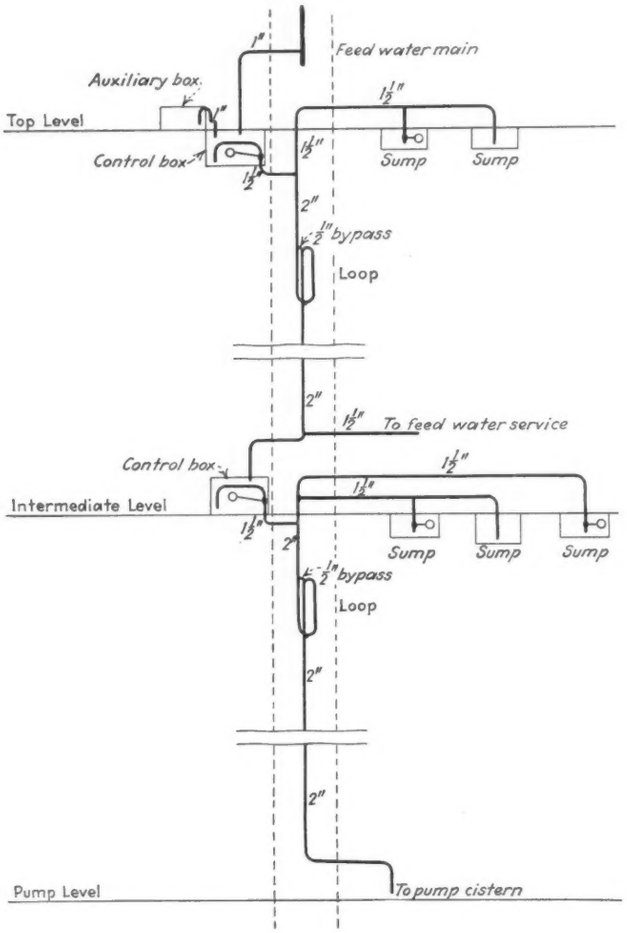


Fig. 2—Diagrammatic sketch of siphon system

of the drainage can be diverted back to the feed-water service at any required level, without cost or trouble.

2. Or an auxiliary box (of volume equal to that of the control box) is placed on a higher level, receives the drainage direct, and is equipped with a ¾-in. or 1-in. "splash" siphon. This is made from ¾-in. or 1-in. pipe and fittings, with two right-angle bends on the outside down pipe. It discharges into the control box. It is possible with a small-bore pipe, when the box is filled with water and overflowing, to obtain a water seal by water splashing at the bends, with subsequent rapid siphoning. Hence the name "splash" siphons. The control box is then filled quickly; the float rises, opens the valve wide, and the siphon starts. However, the 1-in. "splash" siphon is too small to operate the sump siphons, without use of the control box. If all drainage adjacent to the shaft is from ground drains only, the wooden boxes are replaced by concrete sumps equipped similarly, but placed below the drainage level.

On discharge of the top control box, the falling water, on reaching the loop in the down pipe (already filled with water), forms a water seal, and suction immediately takes place in the 1½-in. sump pipes. To equalize pressure, water is drawn over from the sumps into the down pipe, immediately starting a series of siphons, all discharging into the 2-in. down pipe, and thence to the control box on the No. 2 level. The top-level control box continues discharging until the float closes the valve (the end of the siphon pipe in box being still under water). The sump siphons, however, continue, but will stop as soon as air is introduced into the pipes. Therefore it is necessary to prevent suction of air until the last sump has been emptied. This is accomplished by (1) valves, placed in the pipe line over each sump, which arrangement so regulates the flow that all sumps cut out at the same time; a small-volume sump will then have its valve nearly closed, and a large-volume one its valve wide open; or (2) float valves on all sumps but one which shut off the suction pipe before the water level has fallen sufficiently to admit the air. Of necessity, the sump with the open pipe is the one that, if each were operating independently, would take the longest time to discharge. This would involve the two factors —volume of water and distance from the shaft.

As the sumps empty, air is sucked in and is bypassed through a ½-in. cross connection in the shaft, leaving the loop filled ready for the next discharge of box.

When an inflow of water takes place, No. 2 control box siphons and transfers water from No. 2 series of sumps to No. 3 control box on No. 13 level. This operation is repeated from level to level until all drainage water has passed through the siphons, either to the pump level, or has been diverted—all, or in part—into the feed-water service.

The drainage water has no suspended matter in it. Care is taken to have all suction pipes 6 in. to 1 ft. from the bottom of the boxes to prevent any foreign matter from being sucked in. This siphoning system represents a valuable saving of water. The longest distance at which a sump can be placed from the control box has not been determined. Sumps 1,100 ft. away have been successfully operated.

Advantages and Disadvantages of the System

The system, being automatic, requires little attention and supervision. No power costs are incurred. The pipes are regularly scoured, and therefore are not liable to clog. The system, when running continuously, will handle any quantity of water up to the limit of the capacity of pipes used. Water is conserved for feed-water service.

The disadvantages of the system are seen in heavy capital outlay if the collecting points are far apart and if little water accumulates. Clogging of one control valve will result in flooding, as the remainder of the system above will continue operating.

This system of automatic siphoning does not perhaps present any new features, but, by combining a series of old features, an effective method of controlling drainage water has been developed, and is still capable of further improvements.

No mention has been made of any other methods of handling drainage water, such as by ejectors or small pumps. These are well known, and as the method described successfully replaces them, it is not necessary to discuss their application in this consideration of subsidiary mine drainage.

USEFUL OPERATING IDEAS

A Feed Leg for Hand-Held Drills

By Leslie E. Dick
Assistant Superintendent, Montreal Mining Company, Hurley, Wis.

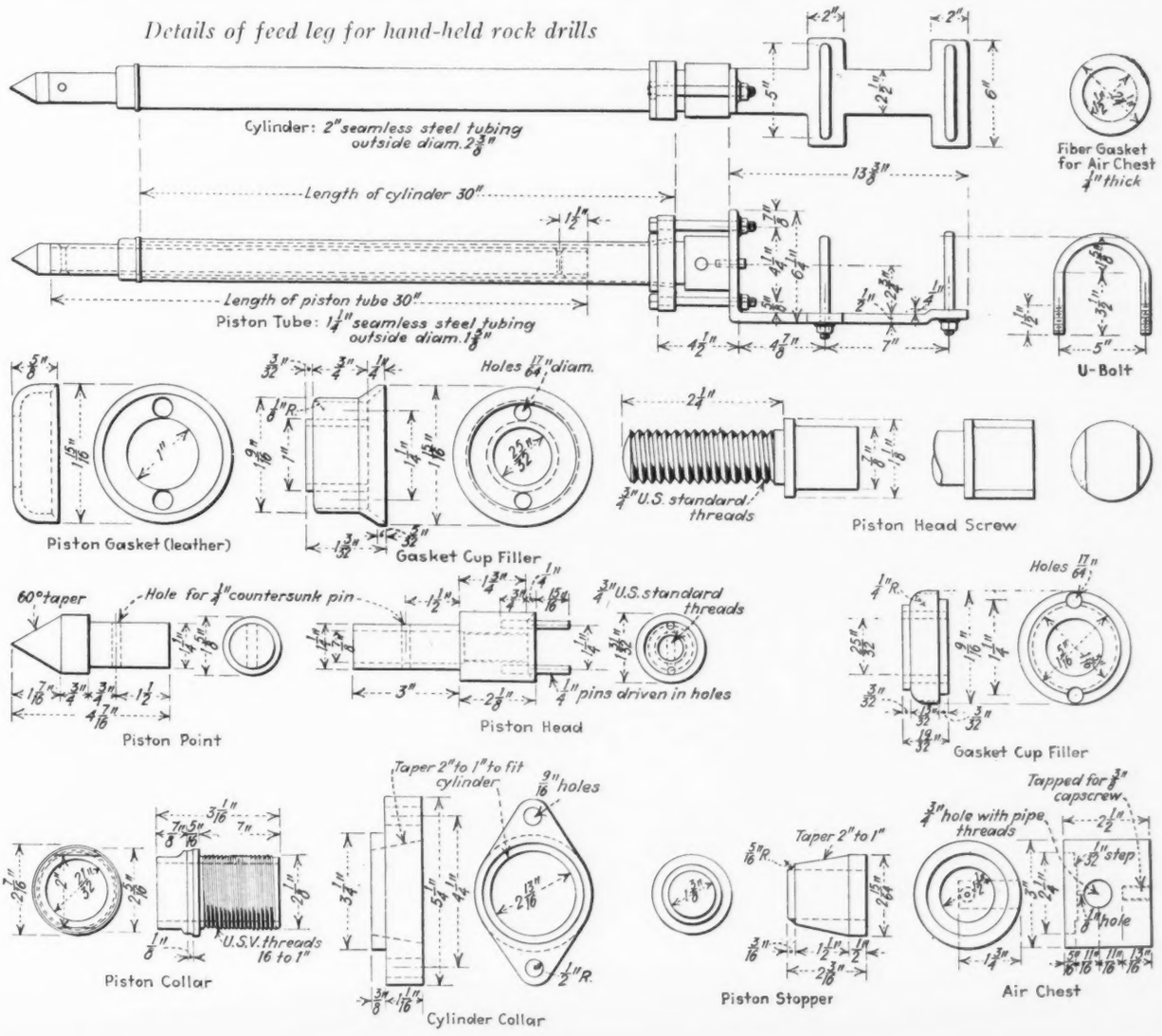
ONE of the hardest jobs a miner has to do is to drill a vertical or upward-pointing hole with a hand-held drilling machine. He has to hold the whole weight of the drilling machine and drill steel as well as keep the steel tight against the ground, and do this in spite of the vibrations of the machine. This is true of machines of the auger and jackhammer type.

Some of the drill manufacturing companies make an air-operated feed leg which replaces the handle and back head of the drilling machine and which works well. The miner is relieved of excessive physical strain and the hole is drilled faster. However, because the leg is permanently attached to the machine, the drilling machine cannot be used for flat or horizontal holes.

In many working places underground it is necessary to drill both upward-pointing holes and flat holes. To avoid the necessity of having two drilling machines in each of these working places, a detachable feed leg has been developed at the Montreal mine, at Hurley, Wis. This device is patterned somewhat after the feed leg on the ordinary stoper drill. Instead of the leg being attached directly to the machine, it is firmly bolted to a strong iron strap. Two U-bolts, designed to fit around the cylinder of the drilling machine, pass through the iron strap. Thus the drilling machine is tightly held on the center line of the feed leg, and the handle and back-head of the machine need not be removed.

To attach or remove the drilling machine from the feed leg all that is necessary is to bolt on or remove the

Details of feed leg for hand-held rock drills

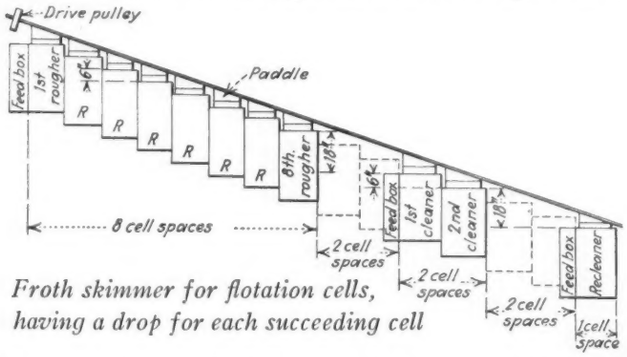


two U-bolts that go around the cylinder. Very little time is required for this operation. A piece of ½-in. hose about 15 in. long, connected with a throttle valve similar to the one on the drilling machine, is attached to the main compressed-air hose near the machine. By regulating this throttle valve, the pressure of the feed leg is easily controlled.

The cost of making a feed leg in the mine shops is between $25 and $30, depending on the number made.

New Froth Skimmer Proves Successful

RECENTLY a series of M.S. Sub-A machines were installed in the flotation department of a large copper producer, writes C. W. Tandy, of Winnipeg, Canada. One of the design problems was the mechanical removal of froth. The standard method of employing paddle blades mounted on a shaft required modification because the rougher cells, eight in number, were stepped so that each succeeding cell was 6 in. lower than its predecessor. The cleaner cells, two in number, were likewise stepped, with the first cleaner cell 18 in. below the eighth rougher cell. So that one shaft might serve all the rougher cells,



Froth skimmer for flotation cells, having a drop for each succeeding cell

it was inclined, with the paddle blades made parallel with the froth surface. Each revolution of the shaft caused the blade to generate a frustrum of a cone.

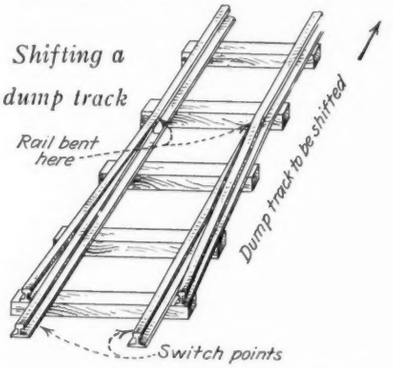
Preliminary plans indicated a chain drive from the rougher shaft to the cleaner shaft, and a chain drive from the cleaner shaft to the recleaner shaft. This arrangement was undesirable, because the planes of the sprockets were not vertical. So the scheme of putting two cell spaces between the eighth rougher and the first cleaner and two cell spaces between the second cleaner cell and the recleaned cell was devised. Thus it became possible to drive all paddle blades by one shaft, with one paddle blade for each cell. The torque was equally distributed for the eleven blades through 360 deg. The shaft and the blades when assembled resembled a high-pitch screw. Operation proved the skimmer a success, and credit is due to the designer, E. H. Anderson.

Pressure Filter Dewaters Colorimeter Samples

A SIMPLE and effective pressure filter is used in the colorimeter method of assaying at the Copper Queen concentrator, states E. Wittenau, superintendent. This filter consists of a 9-in. pipe 14 in. long, set vertically on four legs. A top lid and bottom plate, hinged, have a gasket inset and are brought into place and held by cam levers, thus doing away with nuts and threads. The bottom plate is drilled with $\frac{3}{16}$-in. holes on $\frac{5}{8}$-in. centers. To filter a sample, a canvas and filter paper are put on the bottom plate and brought up to the bottom of the cylinder and tightened with a cam lever. The sample is poured into the cylinder and the top cover tightened with a cam lever. Air pressure is introduced into the side of the cylinder. The method of dewatering samples in this way greatly facilitates colorimeter determination and assures accuracy. No part of the sample is lost, as would be the case with decanting. With this arrangement an almost dry filter cake is produced in five minutes. The colorimeter method is described in the Phelps Dodge issue (Oct. 27, 1928) on page 683.

Ingenious Scheme Simplifies Dump-Track Shifting

ONE of the jobs that is ever with us in mining work is the shifting of dump tracks, writes C. N. Schuette, of San Francisco. Not the least of the annoyances or difficulties of this job results from the fact that, during shifting, the track is either lengthened or shortened. A simple scheme to offset this difficulty is illustrated in the accompanying sketch. The last length of

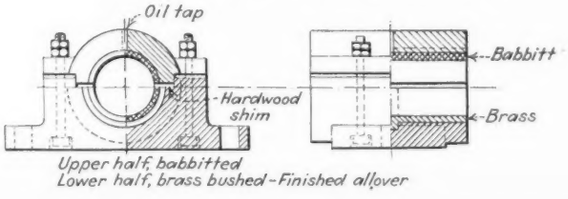


rail to be shifted is bent outward with the rail bender as shown, and switch points are laid at the end of the permanent track. Any lengthwise shifting of the dump track as it is moved is taken up at this joint; and, after the track has been shifted, a few judicious blows with a double jack will adjust the joint. The use of this joint saves a great deal of time in shifting track.

A Bearing That Can Be Quickly Repaired

A TIME-TRIED large bearing, used during the last decade by a well-known Utah mill on its elevators and shown in the adjoining cut, has been described by C. W. Tandy as an adjustable-wear, split, rigid pillow block. The upper half is babbitted, and the lower half, where most of the wear takes place, has a removable brass bushing, kept in place longitudinally by an annular ring recessed into the lower casting and prevented from rotating by the upper casting.

An adjustable-wear split, rigid bearing



Personal Notes

HARVEY S. MUDD is in New York.

FRED HELLMANN is now residing in Los Angeles.

PERCY E. BARBOUR is making a professional trip to Nevada and California.

E. L. OLIVER returned to San Francisco late in October after a trip to Europe.

ROBERT E. CRANSTON, mining engineer, of New York, is on his way to New Zealand.

CHARLES A. MITKE sailed from San Francisco on Oct. 20 for Sydney, Australia, on professional business.

AMOR F. KEENE has returned from southern Alaska, where he spent a month on professional business.

BASIL PRESCOTT, geologist, who has been in Mexico on professional business, returned recently to Eureka, Utah.

J. T. SHIMMIN has been made chief engineer of the Southwestern Engineering Corporation, of Los Angeles.

HOYT C. PERRING, mining engineer, has returned to San Francisco after examining tin properties in Bolivia.

F. R. WEEKES is in British Columbia on professional business. He will return to Montreal early in November.

CHARLES BRACKIN, of San Francisco, was in the Sudbury Basin district of Ontario during August and September.

J. POWER HUTCHINS, mining engineer, has returned to San Francisco, where he expects to take up his residence.

F. C. TORKLESEN, of General Engineering, is at Quartzburg, Idaho, arranging for the remodeling of the Talache mill.

L. H. METZGAR, general superintendent of Alaska Juneau, is in San Francisco on his annual visit to company headquarters.

M. VAN SICLEN, consulting mining engineer, of Washington, was in the Salt Lake district recently on professional business.

PHILIP R. BRADLEY has returned to San Francisco from the Errington mine of Treadwell Yukon, of which he is consulting engineer.

FRANK M. ESTES, mining engineer, is returning to Chihuahua, State of Chihuahua, Mexico, after a visit to New York and Washington.

E. E. MCCARTHY, resident manager of the Yukon Gold Company, left San Francisco late in October for the Federated Malay States.

SHERWIN F. KELLY, assistant manager of Schlumberger Electrical Prospecting Methods, has moved his family from Toronto to New York.

T. S. CARNAHAN, assistant general manager of Union Minière du Haut-Katanga, with headquarters in Brussels, Belgium, is visiting Western mining districts.

H. FOSTER BAIN, secretary of the A.I.M.E., has returned to New York after attending the Tri-State Zinc and Lead Producers' Association meeting at Joplin, Mo.

C. R. WILFLEY is now located in the C. A. Johnson Building, Denver, Colo. Mr. Wilfley is the Colorado representative of Schlumberger Electrical Prospecting Methods.

J. J. JAKOSKY, consulting engineer, and A. B. MENEFEE, mining engineer, of the Radiore Company, Los Angeles, were in the Salt Lake district recently on professional business.

EDWARD L. STENGER, for several years geologist for the W. A. Clark interests at Butte, Mont., is now geologist at the Errington mine of Treadwell Yukon, at Bradley, near Sudbury, Ont., Canada.

HARRY T. CURRAN, consulting engineer to the R. A. Perez Company, of Los Angeles, has returned from a trip on which he examined the Ohio Mines, at Rebel Creek, Nev., and a mercury deposit west of Fresno, Calif.

L. C. PENHOEL, president of Southwestern Engineering, has left Los Angeles for the Southwest and Mexico. He will visit the Cabrita mine at Santa Barbara, Chih., where development work is under way. He will be gone about a month.

DR. E. T. HODGE, professor of economic geology at the University of Oregon, has just returned from the district near Mount Hood, where he spent the larger part of the summer making a geological map, in which special attention was given to hydro-electric power sites and water supply for near-by cities.

R. L. AGASSIZ, president of Calumet & Hecla Consolidated, was re-elected president of the Copper and Brass Research Association at its eighth annual meeting, held at its offices in New York on Oct. 25. Other officers elected were F. S. CHASE, WALTER DOUGLAS, BARTON HASELTON, and THOMAS D'A. BROPHY, vice-presidents; STEPHEN BIRCH, treasurer; WILLIAM A. WILLIS, manager; and JOHN F. GOWEN, secretary.

OBITUARY

M. J. GAVIGAN, assistant foreman of the Mountain Con mine of Anaconda Copper at Butte, Mont., died recently in Butte. Mr. Gavigan, who was 41 years old, was Democratic nominee for Sheriff of Silver Bow County at the time of his death.

EDWARD W. PACKARD, who was interested in several mining enterprises in the Salt Lake district in the 'nineties and the early part of the twentieth century, died on Oct. 27, at Greenwich, Conn., at the age of 76. Mr. Packard, a native of St. Louis, was associated with his uncle, John Q. Packard.

M. B. TOMBLIN, secretary of the Colorado chapter of the American Mining Congress, and also secretary of the Colorado Mining Association, died at Denver on Oct. 16, after a long illness. He was 69 years old. Mr. Tomblin was a native of Illinois, going to Colorado in 1897. He founded the *Boulder County Miner* and was one of the organizers of the Boulder County Metal Mining Association. In 1915 he was appointed deputy state commissioner of mines, and in 1916 became secretary of the Colorado Mining Association. He was also formerly secretary of the Western division of the American Mining Congress.

JOHN FLESHER NEWSOM, mining engineer, of San Francisco, former professor of mining and geology at Stanford University, died in Washington, D. C., on Oct. 24, at the age of 59 years. He was a classmate of Herbert Hoover at Stanford in 1892. He married Adelaide F. Perry, of Bloomington, Ind., and a son, John B. Newsom, resides in San Francisco. In 1901, Mr. Newsom received a Ph.D. degree at Stanford and was appointed professor of mining and geology. He held this post until 1909, when he entered private engineering practice. He was on the engineering staff of the Guggenheim mining enterprises. A few years ago he retired from active practice.

FRED M. PRESCOTT, president of the Prescott Company, Menominee, Mich., died on Oct. 17 from pneumonia, after a short illness. Mr. Prescott was born in Denver on Sept. 30, 1863. He attended Cornell University, from which he was graduated in 1895. For nine years thereafter he was a manufacturer's agent at Ironwood, Mich., supplying the mines in the district with hoisting and pumping equipment. In 1894 he organized the Fred M. Prescott Steam Pump Company, of which he was president. This company was absorbed by the International Steam Pump Company in 1912. Mr. Prescott then formed the present Prescott Company, at Menominee, which specializes in the construction of electric and power-driven pumps. The Michigan College of Mining and Technology adopted a resolution to be sent to the members of his family, part of which follows: "Whereas, Fred M. Prescott, member of the board of control of the Michigan College of Mining and Technology, has completed his course in life and has passed into the great beyond, we, the faculty of the Michigan College of Mining and Technology, express our appreciation of his service to humanity and to this institution."

COMMENT AND CRITICISM

Interest Confined to High-Grade Gold Prospects

Profitable Opportunities in Developing Large-Tonnage Low-Grade Mines Neglected Because of Cost of Ore Survey

THE EDITOR:

Sir—Mining papers and mining men for many years have led the prospector and mine owner to believe that the "big fellows" are looking for low-grade gold mines, that scouts are out all over the country searching for just such mines. My experience is that this is fiction: what they are looking for are high-grade mines. An engineer of my acquaintance has been developing a low-grade gold mine for the last five years, which is within five hours' drive of a big city, and during this time not one scout has visited the property, nor any engineers, except those invited. If there was such a demand for such properties, surely several or many scouts would have been looking it over.

Now, the question is what is a low-grade gold mine and how much work must be done before a reduction plant is justified? A low-grade gold mine is one that must be mined on a big scale. Treating 100 tons a day is considered a fair-sized gold mine; over 1,000 tons a day is considered a whale of a mine. To make sure we have a low-grade mine we will start by mining 5,000 tons a day, or 1,800,000 tons a year. We may also figure that the deposit will be worked out in five years, so we must have 9,000,000 tons of ore blocked out or reasonably developed. In five years, then, the original outlay must be returned, as well as interest commensurate with the risk. Suppose this ore is in a block 500 ft. cube. We may imagine two tunnels or adits at top and bottom, connected by raises and horizontal drifts to the limits of the ore. This will require about 5,000 ft. of work, say at $7 a foot, or $35,000. Add to this $10,000 for equipment, and we have $45,000, or nearly half a cent a ton. The cost of blocking out ore in big mines varies from one cent to five cents a ton, but in an ideal deposit, such as is necessary for low-cost gold mining, half a cent a ton is not out of the way.

It may be well to tabulate the various physical characteristics of low-grade gold mines that may be worked at a profit.

As to mining: (1) The mass must be loose, suitable for power shovels or glory-hole mining. As to concentration: (2) gold in the fines; (3) screening to ¼ mesh; (4) screening ratio by trommel screen 1 to 6, by water concentration 1 to 1,200; (5) reject has no values; (6) deposit has no overburden; (*7a*) treatment by cyanide in sand tanks; (*7b*) treatment by cyanide of concentrates; (*7c*) treatment by amalgamation; (8) no cyanicides in the ore; (9) ore neutral; (10) reject discarded by gravity.

These are ideal conditions for low-cost gold mining. If we give costs to these various conditions we may form some judgment of the grade of ore that may be made to pay.

As to the screening ratio of 1 to 6 and 1 to 1,200: these are fair averages of practical work. Also, the choice of ¼ mesh for cyaniding is the limit of size that may be cyanided in sand tanks. This ideal deposit is to be mined by power shovels or glory holing and delivered at a trommel screen or mill bin for 30c. a ton. This is a fair cost. For convenience we may consider 90 per cent extraction of the gold content by the three processes enumerated.

First we will consider screening and cyaniding in sand tanks—5,000 tons a day; screening ratio, 1 to 6; initial outlay $250,000.

Mining 5,000 tons per day, at 30c.	$1,500
Cyaniding 833 tons per day, at 40c.	335
Amortization, per day	140
Total	$1,975

This gives 40c. a ton, plus 5c. loss, or 45c. to pay without profit. If the screenings were amalgamated, the grinding to 40 mesh would just about equal the cost of cyaniding in sand tanks, but the initial outlay would be at least twice as great, or an added 5c. a ton to cover this item. If the ore is to be concentrated in water before cyanide treatment, all must be ground, so we have:

Mining 5,000 tons per day, at 30c.	$1,500
Milling 5,000 tons per day, at 24c.	1,200
Amortization	500
Total	$3,200

This gives 64c. a ton plus 5c. loss, or 70c. a ton.

It would then appear that a mine in which the gold is in the fines, with ore that can be treated in sand tanks by cyanide, is the ideal mine for low costs. The deciding factor between cyaniding in sand tanks and amalgamation is the initial outlay.

By reason of being able to screen out a barren reject, the ideal mine has the best of the concentrating example, as the cost of milling is spread over more tons. If we vary any of the ideal requirements we increase the costs. A fair example of what may be found in nature is here given to show what may be a profitable low-grade gold mine: (1) Mass loose, suitable for power shovels with occasional blasting; (2) gold in fines; (3) screening ratio 1 to 4; (4) screening to ¼ mesh; (5) reject of ore goes 20c. a ton; of overburden, 10c.; (6) overburden averages 65c. a ton and twice as much overburden as ore; (7) treatment in sand tanks by cyanide with 90 per cent extraction; (8) no cyanicides in ore; (9) ore neutral; (10) reject discarded by gravity.

We first make a rough estimate of cost to determine whether the overburden will pay to work or whether its removal is a loss:

Mining and screening 5,000 tons per day, at 34c.	$1,700
1,250 tons cyanided, per day at 40c.	500
3,750 tons reject, per day at 10c.	375
Loss in tailing, per day	288
Amortization, per day	140
Total	$2,993

This gives 60c. a ton, showing that the overburden will pay to work in with the ore. Now, if the ore goes $1.25 a ton and the overburden 65c. a ton, and we must work one of the former to two of the latter, we have an average of 85c. a ton, and the average reject at 13⅓c. a ton, the screening ratio remaining the same.

We are mining:

5,000 tons per day, at 34c.	$1,700
1,250 tons cyanided per day, at 40c.	500
3,750 tons reject per day, at 13⅓c.	500
Loss in tailing, per day	375
Amortization, per day	140
Total	$3,215

This gives a working cost of 64c. a ton, or a profit of 21c. a ton, or $1,890,000 on the block of ore in five years—a very handsome return on the initial outlay.

The known ore deposits that will satisfy these requirements are scarce, not because none exist, but because of the

expense of proving or blocking out millions of tons of ore of sufficient grade. The "big fellows" are not taking a long chance; it must be there. The prospector cannot afford the expense involved, so he passes over these low-grade masses and looks for high grade ones; and the follower-up—the scout—does the same.

ALGERNON DEL MAR.
Los Angeles, Calif.

When Is a Gold Brick Not a "Gold Brick"?

THE EDITOR:

Sir—Recently, in cleaning out some pigeonholes in my desk, I came across a pre-war clipping of *Engineering and Mining Journal,* entitled "A Gold Brick." After removing some of the attendant dust from the clipping, as well as some of the cobwebs from my memory, it struck me that in view of recent developments it may be of passing interest to review the aforesaid "Gold Brick." The first paragraph of the article reads:

"My client, with whom I was traveling, stopped suddenly in our deck promenade, and with a satisfactory chuckle, said, 'Hardinge, I was once accused of selling a gold brick. Here's one for you: When is a gold brick not a "gold brick"? I'll give you the answer: When it's a brick of gold.' "

In the squib I used no names, either of individual or mine, but as several of the parties interested have since passed over the "great divide," and as the "brick," metaphorically speaking, has become encrusted with diamonds, it may interest some of your Canadian readers to know that my client was Colonel Robert M. Thompson, who had associated with him the late Ambrose Monell and Captain DeLamar. The mine was and is known as the International Nickel Company's famous Creighton property.

At the time referred to I was on my way to Spain on professional business for International Nickel. The parties who originally bought the mine composed a Cleveland syndicate.

The balance of my article is as follows:

"He then explained: 'You know this "gold brick" mine; you've examined it. I bought it for $100,000 because I knew it had great possibilities, but later I realized that it would require more for equipment than I had in hand at that time. Accordingly I recommended it to friends in the West, whose means were in proportion to the mine's necessities. They took the mine over for $200,000, and operated it for about a year. During this time they built a smeltery. I had retained a small stock interest and kept my eye on the operations, making suggestions from time to time. Later, I entered a protest which resulted in a slight estrangement, and finally culminated, after repeated failures on their part, in the accusation that I had sold them a "gold brick"—this even in view of the fact that during their operation they had increased the ore supply by many thousands of tons. At the same time they had increased the mine's obligations. Matters went from bad to worse until, in exasperation, I asked them their price for the "gold brick." They named $200,000, the figure for which they had originally purchased the property, plus 6 per cent, under a three months' option. When the papers were presented the consideration had risen to $275,000. Upon explanation it appeared they had put in their smelter equipment at $75,000. I told them I had no intention of purchasing the cause of their failure. Finally a new set of papers were made out for $200,000, plus interest. I then presented the proposition, together with my views, to some of my friends, with the result that we jointly took over the property and equipped it properly.' "

Colonel Thompson, I believe, still retains a considerable interest in the mine, while I myself have been a small stockholder for several years, having seen the stock range in price from $12 to about $160, at which figure it is now quoted.

The mine is under the highly efficient management of a personnel which, at the time of my first writing, was composed of the employees of the company. It is probably to them that a large amount of the credit for the present condition should be attributed.

Canada has many other similar "gold bricks" in the making.

H. W. HARDINGE,
President, Hardinge Company.
New York City,
Oct. 17, 1928.

More About South Dakota's Tin and Other Mineral Resources

THE EDITOR:

Sir—I have been furnished a copy of the article appearing in *Engineering and Mining Journal* entitled "Tin Industry Boosted by Agricultural Expert." I have noted your comments upon the article, which was written early last spring and appeared as an Associated Press article first in all of the daily papers of South Dakota, and, I think, in the Minneapolis, St. Paul, Omaha, and Sioux City papers, for the Associated Press correspondent in Pierre furnishes material in that circle. So, the assertion that The Associated Press did not handle the article is an error, and as yet I have found no one to dispute the claim which Mr. Bland made to me that this is the largest tin mill in the world and the only one upon the North American continent. If you have any data to dispute this claim, I certainly would be pleased to have it.

The prices for the concentrates both of tantalum and tin were furnished me by Mr. John Bland, manager of the mine, as the market price at that time.

I visited, in company with Frank L. Hess, of the Bureau of Mines, of Washington, another columbite and tantalum vein a few weeks ago where two men with a pick and wheelbarrow had taken out $2,800 worth that week and were receiving 55c. per pound for it on track at Pringle.

While I am not a practical miner or engineer, I do know tin ore when I see it. I have the report of the mining engineer and geologist made on the Tinton mine, covering several pages of manuscript and there is no question about his findings, which verify the claim which I have made for the Nigger Hill mine.

There is also, apparently, a larger amount of tin ore yet in the territory southwest of Deadwood and splendid prospects have been found at Hill City, in the vicinity of Mount Harney.

I want to say to you that the country has not realized the vast mineral deposits of the Black Hills, including paint pigments and glass materials. I will have a series of some twenty articles on the various minerals and non-metals which are found in the Black Hills and which will appear from time to time, and I believe these will be authentic because they are not written in a haphazard way, but the data are secured by an actual visit to the deposits and a thorough study of them made in co-operation with mining engineers and with our own South Dakota School of Mines.

In regard to the date which the Tinton tin mill would commence operations, that was set for July first in the early spring. As is many times the case in mining vicinities, there are many things which cause delay, and some misunderstanding arose, I understand, between John Bland, the promoter, and John Beatty, the financier.

I do not feel that I have been overenthusiastic about the claims I have made for the mineral resources of the Black Hills; in fact, the more I delve through those regions the more I become convinced that one could not paint them too graphically, for the ultimate resources will eventually prove that every claim is justified. The only trouble is that the world at large has not realized nor can hardly conceive the great resources which we have from an agricultural, mineral, and power standpoint in South Dakota.

The last year has seen inquiries from representatives of capital to a larger extent than throughout our entire history, and I feel that great development will take place in the future.

You mention the fact that the company does not desire publicity, and I beg to state that Mr. Bland was heartily in accord with it and that the change in that policy was made since I wrote the article. I assure you that I never give publicity where the people who own the mines and resources request that it be given. LOUIS N. CRILL,
Secretary of Agriculture of
South Dakota.
Pierre, S. D.

[As to the propriety of designating the original mimeographed bulletin is-

sued by Mr. Crill "An Associated Press Article," we are advised by that news-gathering organization that neither Mr. Crill nor any one else outside of The Associated Press was authorized to designate the material thus, and that Mr. Crill has given assurances that he will not do this again. The statement that the Tinton concentrator, which is to handle 300 tons a day, is the largest tin mill in the world is unacceptable in view of the fact that the Patiño mill, in Bolivia, treats more than 800 tons per day. There is no evidence available to indicate that the South Dakota tin deposits, in their present stage of development, are equal to those found anywhere in the world.—THE EDITOR.]

Memorial to Army Engineers Revives Old Spirit of Belgian City

THE carillon presented to the University of Louvain by American engineers has revived the pre-war spirit of that city, according to letters received by Alfred D. Flinn, of Engineering Foundation. Says Dr. L. Van der Essen, secretary of the university, in a communication to Mr. Flinn:

"The ringing of the bells has transformed Louvain. From a city which seemed dead and dull since 1914, when the carillon tumbled down under German fire, it is now a town full of memories, and the carillon has become a sort of pilgrimage place, where every day many people come to see the American memorial and to look at the stars of the clock representing the American states which contributed to the erection of that splendid gift.

"There has not been a day during which motorcars have not brought people from all sides of Belgium to visit the tower and the bells. Many Americans have already passed by, proud of their country and filled with friendly feelings toward those who watch over the memorial of the fallen engineers.

"There was a moment when every man of Louvain has had tears of emotion in his eyes. That was on Aug. 4 last, at 9:30 in the morning, when, as in every year since the end of the war, all the bells of Louvain were ringing in memory of the violation of Belgian soil by the German army.

"Suddenly, the Liberty Bell began to strike, overpowering all the other bells of the city. Many persons ran to the Place du Peuple and stood there, looking at the tower, as if the voice of the dead American engineers was filling the air and saying:

" 'This is the Liberty Bell, now ringing in free Belgium on this fateful fourth of August. Remember that we died that you might live and be free.'

"I, personally, staying in the garden of my home, having listened, with my family, to the voice of the Liberty Bell, and deeply impressed, have prayed for the dead engineers.

"The rector of the university, Monsignor Ladeuze, is specially proud of 'his' carillon. I have surprised him more than once toward the evening in his garden listening to the bells."

Monsignor Ladeuze, writing to Dr. Edward Dean Adams, chairman of the War Memorial Committee of the American engineering societies, which raised $80,000 to provide the new Library Building of the University with its clock and carillon, declares:

"The splendid memorial to the American engineers who fell in the war was, without doubt, a very noble conception and one which was most agreeable to us all. It represents so fully the sentiments of the donors, and it expresses so adequately the ties of everlasting friendship which exist between your societies and the University of Louvain, that no one could have imagined a better memorial than this great one.

"In the spire of the library tower, the Liberty Bell and the carillon will remain for generations to come the magnificent proof of your generous help, of your lofty ideals of science and humanity, of your noble conception of international solidarity. The University of Louvain owes to you all a debt of gratitude which cannot be repaid."

Consultation

Zinc Ores in New Jersey

"I would be pleased to have your valuable opinion on the following: On a farm in northern New Jersey I secured a specimen of granite, chipped from an outcropping rock, that contained a grayish green vein. This granite was integral with what was apparently a large rock formation lying near the surface and extending as far as the eye could reach. Three chemists have reported the presence of zinc in this sample; one analysis was quantitative and showed 0.1 per cent of zinc. What I would like to know is whether such occurrences of zinc are common on the farms of northern New Jersey, around Sussex County; is the zinc content of these rocks too low to be of value; and if even so low a percentage of zinc can be found in an outcropping rock, is it not possible that the main lode might be richer? What is the usual depth of zinc ore in paying quantities, and what is the usual formation; does it occur in veins or in a rock conglomerate?"

It seems probable that the zinc in your sample occurs as calamine, a mineral usually associated with calcareous rocks. This mineral is known to occur in Sussex County, but we have no knowledge that it occurs extensively in the rocks of that region, nor of any commercial deposits, at the surface or at depth. The only commercial deposit of zinc ore in northern New Jersey is that at Franklin, in veins of Pre-Cambrian igneous origin, lying in limestone at a gneiss contact, and originally outcropping. The orebodies have undergone metamorphism, the chief minerals being the oxides and silicates, willemite, franklinite, and zincite. Mining is now carried on at depths between 1,000 and 2,000 ft. The inquirer is referred to an informative article in *Engineering and Mining Journal-Press* of Feb. 21, 1925, by J. E. Spurr and J. Volney Lewis, on "Ore Deposition at Franklin Furnace, New Jersey."

Possibly some reader can give fuller information regarding the presence of small amounts of zinc in the country rock of Sussex County, and of the possibilities of enrichment at depth.

Variations in Miners' Wage Scales

"Can you tell me if there is any definite scale of miners' wages in Arizona, dependent upon the price of copper?"

There is no definite agreement to raise or lower wages consonant with the price of copper in Arizona or in any of the other important mining camps of the United States, so far as we can learn, though, in making the last advance, the Anaconda Copper Mining Company did specifically state that the increase would continue only so long as the average monthly price of copper, as quoted by *E.&M.J.*, was above 15c. per pound.

In general, producers raise or cut wages when conditions warrant or require it. In Arizona, a sliding scale was in effect before the war, based on a wage of $3.50 per days for miners, when copper was selling for 13c. Under this scale, wages were increased 10 to 15c. each time the price of copper advanced a cent. During the war, when the price of copper was fixed by the government, miners were receiving $5.15 per day. After the war, wages fluctuated according to conditions. On Nov. 1, 1923, after a cut of 10 per cent had been made, they were as follows: Timbermen, $5.23 per shift; miners, $4.95; and muckers, $4.40. These rates persisted until the 10 per cent raise that took effect Oct. 1, 1928. Timbermen now receive $5.75 per shift; miners, $5.45; and muckers, $4.84. However, much of the work is done on some form of bonus or contract basis. Experienced underground men, working on contract, are now earning perhaps an average of about $7.50 per shift in Arizona.

Citrus Oil for Flotation

"Can you tell us whether or not citrus oil has ever been tried as a flotation oil, and, if so, the comparative results?"

This inquiry, coming from a fruit products company in Florida, is doubtless stimulated by an effort to make orange skins a valuable byproduct. Hundreds of oils have been used experimentally for flotation, and it is altogether probable that citrus oil is among the number, but we have no record of results. Certainly it is not used commercially in any work of record. If any reader is hopeful of good results, we shall be glad to put him in touch with the inquirer.

INDUSTRIAL PROGRESS

Reducing the Personal-Element Factor

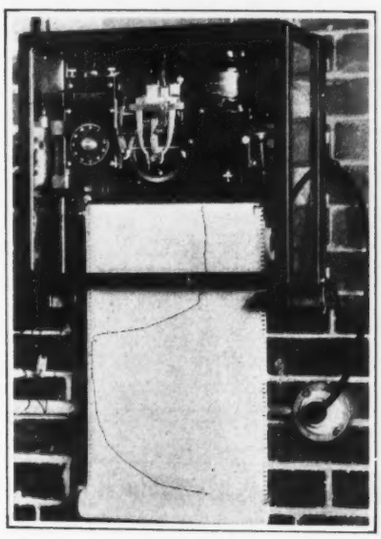
Automatic Indicating and Recording Instruments Prove Essential to Efficient and Economical Operation

IN A RECENT ARTICLE[1] the superintendent of a certain Canadian smelter was quoted as advocating that instruments be used to the fullest possible extent for furnace control instead of relying entirely on the eye of the practical man. Most smeltermen will agree with him. At the same time, it is true that the use of these devices is much more extensive at some metallurgical plants than at others. This may indicate simply an unwise economy or possibly a difference of opinion as to the extent to which the eye may be depended on. Whatever be the reason, it is certain that instruments serve to eliminate guesswork and, to some extent, the human factor. The operator who is getting along without them under circumstances where they would obviously be an aid is possibly standing in the way of his own advancement. Likewise, in power plants the use of instruments is advantageous for indicating and recording temperature, or the pressure and flow of water, air, and steam. A wide variety of such instruments is on the market. Those intended for indicating, recording, and controlling temperature will be considered first.

Temperatures Over a Wide Range May Be Recorded

Instruments may be obtained for recording or indicating temperatures within a range extending from 300 deg. F. below zero to 3,000 deg. F. above or within any portion of this range. Also for temperatures within a so-called "suppressed" range, in which the zero point is some desired temperature, as, for instance, when it might be desired to measure with great accuracy temperatures ranging from 200 to 210 deg. Such instruments include pyrometers and thermometers. The former differs from the thermometer in that it is intended for measuring high temperatures, principally those above a red heat. The various types of instruments for measuring temperatures, together with their range and the accuracy to be expected of them, are listed in the preliminary draft of the A.S.M.E. Test Code. The facts, somewhat rearranged, are as follows:

1. *Glass thermometers, with mercury, alcohol, pentane, or other organic liquids*—Mercury-filled thermometers of ordinary glass are given a range of — 38 to 575 deg. F., with an accuracy of 1 to 2 deg. Those of Jena glass, mercury and nitrogen-filled, or of quartz glass, similarly filled, have a range of — 38 to 1,000 deg. F., with an accuracy of 2 to 10 deg. Thermometers of ordinary glass, alcohol-filled, are given a range of — 100 to + 100 deg. F., with an accuracy of 0.5 to 2 deg. If pentane be substituted for the alcohol, the range is changed to — 300 to + 70 deg. F., the accuracy remaining as before.



A recording resistance pyrometer. The thermocouple type, however, is most commonly used in metallurgical plants.

2. *Pressure-gage thermometers with vapors or liquids as the actuating fluids*—In general, they are accurate to within 2 to 10 deg. There are two classes:

A. The vapor-pressure type partly filled with liquid ether, sulphur dioxide, ethyl chloride, methyl chloride, and the like. Such thermometers have scales with non-uniform divisions. Their range is as follows: Alcohol-filled, + 200 to 400 deg. F.; mercury-filled, — 38 to + 1,000 deg. F.; and sulphur-dioxide-filled, + 20 to + 250 deg. F.

B. Thermometers completely filled with a liquid or gas, such as mercury, alcohol, nitrogen. These have uniformly divided scales. Their range is: Alcohol-filled, — 50 to + 300 deg. F.; mercury-filled, — 38 to + 1,000 deg. F.; and nitrogen-filled, — 200 to + 1,000 deg. F.

3. *Differential expansion thermometers or pyrometers*—In these the differential expansion of two solids is used as an indication of the temperature. Their range is from + 300 to + 1,000 deg. F. Their accuracy is uncertain.

4. *Electrical resistance thermometers*—With these temperature is determined by measuring the resistance of a calibrated wire: Their range is from — 300 to + 1,800 deg. F. and their accuracy 0.001 to 10 deg., depending on the indicating instrument. (One maker states that with his product temperatures up to 200 deg. F. may be measured within 0.02 deg. F., and up to 900 deg. F. with an error of only 1.2 deg. F.) This instrument is a pyrometer when used at high temperatures (above red heat). In such applications some prefer to call the instrument a resistance pyrometer.

5. *Thermocouple (or thermoelectric) pyrometers, or pyrometers in which the electromotive force set up at the junction of two dissimilar metals is used as an indication of temperature*—These are of two types: Base-metal, having a range of — 300 to + 2,000 deg. F. and an accuracy of 0.02 to 20 deg., depending upon the indicating instrument; and rare-metal, with a range of 0 to 2,800 deg. F. and an accuracy of 0.1 to 20 deg., also depending upon the indicating instrument.

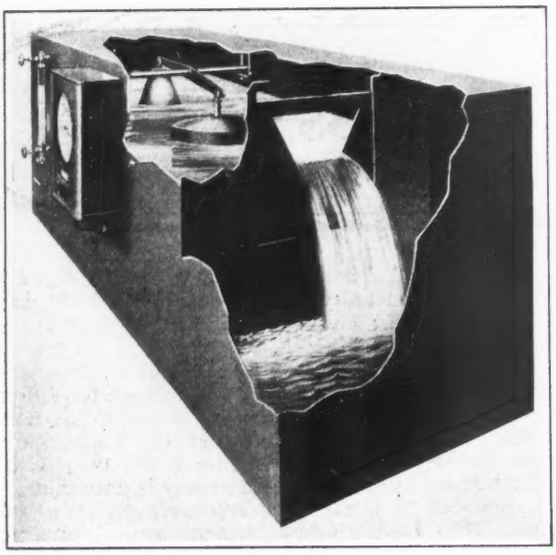
6. *Optical pyrometers*—With these, temperature is determined by matching the luminosity of the hot body with that of a calibrated source or by other means which utilize the visible radiation emitted from a hot body. Their range is from 1,100 deg. F. up and their accuracy 5 to 10 deg. for black-body conditions.

7. *Radiation pyrometers*—In using these instruments, temperature is determined by absorbing radiation of all wave lengths upon a small body and determining the temperature of the source by the temperature attained by the absorber. These have a range of from + 300 deg. up and an accuracy of 20 to 30 deg. F. for black-body conditions.

8. *Fusion pyrometers*—Temperature is determined by noting which of a series of materials with graduated fusion temperatures melt or soften when exposed to the temperature under investigation. These have a range of from 1,100 to 3,600 deg. F. and an accuracy, in the best makes, of 20 deg.

Besides the foregoing eight classes of temperature-measuring instruments, there are calorimetric devices having a range of 100 to 2,500 deg. F. and color-

[1] *E.&M.J.*, Sept. 22, 1928, Page 455.



A weir flow meter of the V-notch type

temperature charts, of a range of 800 to 2,900 deg. F. These are all uncertain as to accuracy.

At present the thermocouple pyrometer is widely used for measuring temperatures between 600 and 2,800 deg. F. (and sometimes to 3,000 deg. F.). Above 2,800 deg. F. the optical type is employed, and, in certain applications, at temperatures as low as 1,400 deg. F. To measure the lower ranges of temperatures (below 600 deg. F.) some type of thermometer is customarily used.

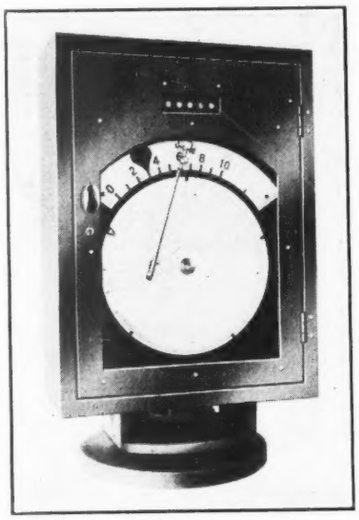
Recording Temperatures Advantageous

Temperatures, past and present, may be recorded by combining with the mechanism of the types of instruments already described some device by means of which a record may be made upon a chart moved by clockwork. A reliable recording pyrometer or thermometer, properly located, gives a twofold service. While the record is being made the operator uses it directly or through automatic signals; after it is made, the management uses it. The nature of the record obtained may be varied: Temperatures at two or more different points may be recorded on the same chart. Or the record may be duplicated simultaneously at various points about a plant. The advantages of such records are obvious.

Pyrometers for automatically controlling certain operations may also be had in various types. These differ chiefly in the manner in which the temperature fluctuation is made to operate the controlling valve, rheostat, or other device. Automatic control of temperature, however, it must be said, does not seem to be widely applied in plants of the mining industry, to judge from data collected from numerous smelters in the United States, hereafter to be presented. A wider application of the principle might result from a study of the possibilities. Certainly there is opportunity for a more extensive use of it in sharpening and heat-treating drill steel in mine shops.

Two Types of Pressure Gages

Pressure gages, both indicating and recording, are, in general, of two types, whether they are to be used for steam,



Recording unit of a V-notch flow meter (not that at top of page)

air, or gas. The principle of operation involves what is termed the pressure element. This is either a diaphragm or the so-called Bourdon spring.

The essential part of the diaphragm type of gage is a shallow circular metal box having opposite sides of elastic corrugated plates which the pressure of the medium tends to force apart. The amount of movement is actually small, but is multiplied by mechanical means and is indicated by a pointer traveling about a circular dial, graduated to indicate the pressure above atmospheric in pounds per square inch. This type of pressure element is somewhat delicate and is used in gages intended for measuring unit pressures well below 100 lb.

For higher pressures, the Bourdon-spring pressure element is used. This is a flattened metal tube closed at one end and coiled. The medium to be measured is admitted to the inside of the tube, and the pressure exerted tends to straighten or uncoil the tube. This movement is communicated to a pointer which travels over a dial, in the indicating type of gage. In the recording gage, the pen arm is attached directly to the tube and instantly records on the chart any change in pressure. This type of gage is made to record pressure in all ranges, from full vacuum to as high as 12,000 lb. per square inch.

Vacuum or draft gages may be similar in construction to those of the pressure type save that the pressure element may be modified. The simple draft gage indicates the difference between the pressure at the point to which it is connected and that of the atmosphere. The difference in pressure between two points in the gas passages may also be indicated by means of a modification in design. A differential draft gage indicating the pressure drop through the boiler may be used as a gas-flow meter and show whether the air is being supplied in the right proportion for the load on the boiler.

If the proper metal or metals be used for the working parts that are exposed to the medium to be measured, these two types of gages may be employed for measuring the pressures of any ordinary medium, such as steam, air, water, and gas.

Flow Meters

Fluids, whether steam, gas, or water, are measured either for volume, velocity, or weight. To measure the volume of water where the permissible velocity is limited, a meter of the rotary-disk type or of the piston type may be used. The former is more accurate.

The disk meter has a measuring chamber which is divided into two equal compartments by a hard rubber disk. The disk is kept rotating by an unbalanced water pressure caused by the fact that one compartment is continually filling while the other is emptying. The resulting circular motion of a pin at the center of the disk is transferred to a counting mechanism. This type may be used where the velocity does not exceed 100 r.p.m.

In the piston meter, two pistons, side by side, are given a reciprocating motion by the admission of water alternately at the two ends by a slide valve arrangement. The number of strokes is proportional to the volume. The meter should not be used if the velocity is such that the number of strokes is greater than 150 per minute. Though less accurate than the disk type, it can be employed with hot water, whereas the other cannot, because of the rubber used in its manufacture. A tank meter, which is alternately filled and discharged automatically, may also be used where the volume of flow is moderate, say up to 20 lb. per second.

If there be no limit to the permissible velocity, some type of weir meter—either the rectangular weir, or the V-shaped weir, or the "flow-proportional-to-head" type—may be used. These are accurate to within one-half of 1 per cent to 1 per cent. Rectangular weirs

are customarily used for large quantities. The "V-notch" type is used in many kinds of service.

For measuring velocity of flow of water where the quantity is large and the pressure low, the velocity not exceeding 100 ft. per second, an impulse wheel or velocity meter may be used. This device is so designed that the water passes through it in a certain manner causing an impulse wheel to rotate, thus operating a counting mechanism. For higher velocities, the Pitot tube or a Venturi meter may be used. With the former the velocity may be as high as 400 ft. per second, the probable error not exceeding 1 per cent.

The Pitot tube may be used for measuring the velocity of steam also, the permissible velocity and probable error being the same as with water. If the volume be desired, a float meter is employed. This is so designed that a disk or cone float moves against a constant resistance in a passage in which the unrestricted area for the flow varies with the height of the float. A registering device is attached to the float. The permissible velocity is not over 200 ft. per second. To determine the weight of steam an orifice meter may be used.

Recording the Rate of Flow

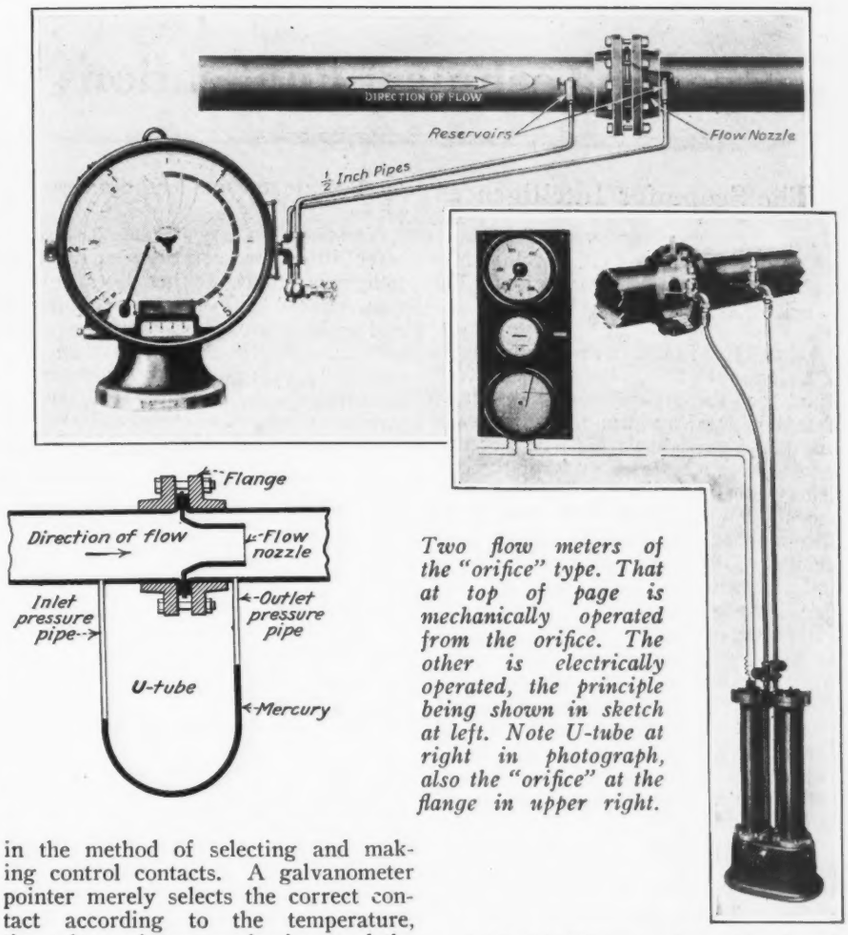
If it be desired to measure steam and other fluids in large quantities so as to obtain a continuous record of the rate of flow, it is accomplished as follows: A differential pressure which varies in a definite and known relation to the rate of flow is produced and measured in terms of weight or volume. This differential pressure may be produced by a thin plate orifice placed in some convenient flange. Meters embodying this principle may be operated electrically or mechanically. They are suitable for measuring practically any fluid, including air and steam, flowing through a pipe line. It is possible to obtain them in combination of recording, indicating, and integrating types and for any pressure from atmospheric to 1,500 lb.

Control Mechanisms Improved

To meet the demand for closer control of temperature, pressure, and flow, many developments have been made on the control instruments and the mechanisms used to operate valves, rheostats, and similar apparatus. Formerly automatic control was merely a recording of "on" and "off." If, for example, the temperature was low, the valve would be opened and the temperature would rise to a high value. The valve would then be closed and the temperature would drop to a low value. In this manner an average temperature was maintained, but considerable "hunting" took place. With the new mechanisms, conditions are anticipated automatically and corrections made before the "hunting" starts. Also, new mechanisms are available which vary the fuel supply in accordance with fuel demand.

In addition to the development of control instruments which would operate the mechanisms mentioned in the foregoing, improvements have been made in the method of selecting and making control contacts. A galvanometer pointer merely selects the correct contact according to the temperature, through a primary mechanism, and the operation of the contacts is taken care of through a secondary mechanism. The advantage of this scheme is to relieve the galvanometer pointer of strain, and at the same time the secondary mechanism has sufficient power to permit the use of wiping contacts. With this arrangement the duration of contact can be altered to meet the control conditions, as it is possible to time the duration by means of a simple adjustment.

Control recorders can be supplied to control several mechanisms from one instrument, the only limitation being that the point of control must be the same on all records.



Two flow meters of the "orifice" type. That at top of page is mechanically operated from the orifice. The other is electrically operated, the principle being shown in sketch at left. Note U-tube at right in photograph, also the "orifice" at the flange in upper right.

Recording CO_2

Several types of instruments may be used for analyzing flue gases. Of these the most widely used is the Orsat apparatus. It consists essentially of a measuring burette, three absorption pipettes, a leveling bottle, and a header. The pipettes contain, respectively, caustic potash solution for absorbing the CO_2, an alkaline solution of pyrogallic acid for absorbing oxygen, and an ammoniacal solution of cuprous chloride for absorbing carbon monoxide. The gases are drawn into the burette and forced out of it by means of the leveling bottle. Thus the water in the bottle acts like a piston in moving the gases to the different parts of the apparatus. The remaining step is to determine the volume of the gases.

A hand indicator such as this, though suitable for occasional tests, does not answer the purpose of daily plant operation, owing to fluctuation in the content of CO_2. Several recorders have therefore been devised which work automatically and which produce a chart showing an average which serves to check operations. One of these is an automatic Orsat apparatus; another is a water-driven Orsat. Still another registers pneumatically the reduction in gas volume caused by the absorption of CO_2 by a dry cartridge of caustic soda through which gas is continuously circulated. In a fourth the CO_2 is absorbed by a caustic solution, the amount of residual gas being indicated by an oil-actuated float. A fifth determines CO_2 through the variation in the density of the gases. Details of construction and operation of these various types are given in the book entitled "Finding and Stopping Waste in Modern Boiler Rooms," recently published in its third edition.

Acknowledgment

In preparing the foregoing description of instruments for indicating and recording temperatures, pressure, and flow, as well as CO_2, several sources of information have been drawn upon, besides those already mentioned. Among these are Marks' "Mechanical Engineers' Pocketbook" and Grimshaw's "Locomotive Catechism"; also the publications of various manufacturers.

(To be continued)

Recent Technical Publications

The Scope for Intelligence

THE TWILIGHT OF THE AMERICAN MIND. By Walter B. Pitkin. New York: Simon & Schuster; pp. 362; price $3.

AN OBJECTION to this treatise is the choice of a title. One assumes beforehand that the author is of the opinion that the American mind is degenerating, and that a twilight period will precede a total eclipse. A brief study of the contents proves reassuring, however, a research having merely developed the theory that the best minds will not have enough to do in the way of constructive industrial work by an arbitrary date, fixed by the author as 1975. Professor Pitkin suggests remedies, but finally, in apparent despair, he closes the book with the thesis "Better a world less good and busier! Better a sea of troubles than a desert of ease! Better the burning dust of tired noons than the twilight of the best minds. But who shall deliver them?" he asks. "And how?"

Professor Pitkin, for the purpose of argument, assumes that one out of every 100 adults is of superior grade of mental ability. This 1 per cent is taken to constitute the best minds. Two propositions are assumed as of basic acceptance: (1) "Give as much work as possible to machines and to system. Give as little as possible to men," and (2) "Never give to any man work which another man of less ability can do equally well, so far as the finished product is concerned." The outcome has been, as we have already learned in the mining industry, that there is not enough work for all those that may be classed among the 1 per cent. It is a peculiarity of high intelligence, says the author, that it can be applied at high speed to a thousand and one problems, simply by invoking the aid of money and mediocre labor. One thousand high-grade minds could lift the entire industrial system of the country to peak efficiency, if they were to receive sufficient money and power to act. "And," Professor Pitkin continues, "as a matter of history, a few hundred men have, in the past five years, achieved tremendous industrial improvements by nothing more difficult than sitting in conference with Mr. Herbert Hoover and a few experts for a few weeks. By taking thought they have added several cubits to the statures of their businesses."

The trend in modern industrialism is in the direction of more efficient organization and the employment of fewer men with superior intelligences. The time and money spent by traveling salesmen is a ghastly waste. Professor Pitkin demonstrates what can be saved and how much time can be conserved by the use of the long-distance telephone.

The new luxury trades at present offer little scope for the surplus of intelligment minds; neither do transportation, finance and banking, engineering and architecture, social and government service. Art, one is told, is an accident and a byproduct of life, not a manufacturing staple. Science, to make vast strides, needs but comparatively few best minds; agriculture no more.

The conclusion reached is that the more intelligently the world is managed, the less intelligence is required to carry the management onward. Yet "there is world-wide shortage of all varieties of executives, from foremen up to rulers of nations; and this is why the world, as a whole, is so abominably managed. There has been a serious concentration of executives in lines of work where cash rewards have been quick and huge; and this has resulted, naturally enough, in a selective elimination of executive best minds, and a dangerous favoring of managers who combine immense energy, social skill, knack of managing men and affairs, and mediocre intelligence." We must, avers Professor Pitkin, soon begin to train leaders in the realms of science, education, culture, and social welfare, not by the dozen but by the hundred. Albeit, this will care for only an insignificant percentage of those who are destined, we are told, to become supermendicants. In the future, it is prophesied, all will be well off, and those with intelligence to do so will have to "hunt facts, invent mechanical devices and toil at social problems."

Professor Pitkin has made a deep study of an interesting subject, but many will consider that he has overstated the case. The definition of a "best mind" is difficult, and many have been placed in that class by reason of a retentive memory and diligence at college. The majority will find useful and congenial work in a sphere far removed from the careers of their aspirations. The United States is not the world, any more than New York City is the United States, despite perpetual inference to the contrary. Mr. Hoover's work at home and abroad indicates that much remains to be done before the supply of intelligent persons exceeds the demand for them in the readjustment of the economic, social, technical, and financial ills that afflict the world at large. The scope, for a long time to come, for an intelligent and broad common sense in the handling of men and material, in the conduct of the professions and in legislative chambers, is such that a person in the best-mind class who can find no useful work to do should be placed in another category.

A. W. ALLEN.

LECTURES ON STEEL AND ITS TREATMENT. By John F. Keller. Evangelical Press, 1900 Superior Avenue, Cleveland, Ohio. Pp. 267, illustrated; price $3.50, postpaid in the United States.

Six lectures are included in this book. They deal with the following topics: Melting the steel and working the ingot; mechanical working of iron and steel; structural changes on slow cooling; determination of critical points and physical testing; hardening, quenching, tempering, and carburizing; and warping, cracking, and shrinking of steel. Considerable pains have been expended in preparing the book, and it should be of use to anyone responsible for any large amount of steel treating. The subject is presented in a practical way, so that the book should find favor with a wide circle of readers.

DIAMONDS—Beginning with the issue of Sept. 19, the *Mining and Industrial Magazine of Southern Africa* is publishing a series of articles on the diamond deposits of Namaqualand. The author is Dr. E. Reuning, of Cape Town, who wrote originally in German. The translation has been made by E. Meister.

SOUTHERN RHODESIA GEOLOGY—Bulletin No. 13 of the Geological Survey of Southern Rhodesia, printed at Salisbury, has been received. It contains reports made by the state mining geologist from February, 1927, to May, 1928. Eight different properties in various parts of the country are covered.

METALLURGICAL ENGINEERING—Dr. E. P. Mathewson is the author of a short article, "The Metallurgical Engineer," which appears in the October issue of the *Professional Engineer*. The article will appear also as a chapter of a book soon to be published by the American Association of Engineers.

MOLYBDENUM WASTE—Reports of Investigations, Serial No. 2888, issued by the U. S. Bureau of Mines, is entitled "Utilization and Prevention of Molybdenum Waste in Oxidized Lead Ore Treatment." The authors are R. E. Head and Virgil Miller. The report contains three pages. The Bureau extends the privilege of reprinting of the article, provided suitable acknowledgment is made. The article, however, is not subject to copyright.

LIST OF BRITISH MINES—The Mines Department of Great Britain has issued a 410-page bulletin entitled "List of Mines in Great Britain and the Isle of Man" for the year 1927. The price is 18s. 6d. net. Coal and metal mines are included. The data given with respect to each property include the name of the owner and postoffice address, name of the mine and its situation, names of the manager and under manager, and the number of persons employed. The minerals and seams worked and the present condition of the property are also stated briefly.

NEWS OF THE WEEK

Summary

AFRICAN copper production should reach 300,000 tons annually by 1935, according to Raymond Brooks, who spoke recently before a joint meeting of the A.I.M.E. and the Mining and Metallurgical Society in New York. Belgian Congo and Northern Rhodesia should contribute approximately equal parts of this total. Page 725.

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Anaconda Copper has been denied the right of having the case brought against it by Carson Investment for alleged infringement of the Carson copper-smelting patent reviewed before the U. S. Supreme Court. Page 724.

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F. W. Bradley, president of Treadwell Yukon, was recently interviewed by a representative of "E. & M. J." in regard to the company's prospects. He expects the ore at the Errington mine to come up to diamond-drill hole results, and sees a profit of $5 a ton at present metal prices. Page 726.

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Smuggler Union, silver-lead-gold producer at Telluride, Colo., will be closed down about Dec. 1 because of exhaustion of ore reserves. Page 722.

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Diamond drills at Calumet & Arizona's Bisbee property have disclosed that the Campbell orebody extends below the 2,200 level, the present bottom. Page 727.

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Phelps Dodge is undertaking an extensive new development program at the Copper Queen in the Bisbee district. From 200 to 300 men will be needed to carry it out. Page 724.

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An experimental plant, with a capacity of 50 tons daily, is being constructed at Hillside, Ariz., for Bagdad Copper. Page 723.

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Badger State, one of the Anaconda mines at Butte, is being reopened after a shutdown of about eight months. Page 725.

International Nickel Announces Capital Readjustment

No Official Word of Merger With Mond—Mine Development Will Strike Orebody Soon and Treatment Plants Are Under Way

OFFICIAL announcement was made this week of a proposed reorganization of the capital structure of the International Nickel Company and the International Nickel Company of Canada, Ltd. Heretofore, the first-named, operating under a New Jersey charter, has been the holding company for the Canadian subsidiary, all outstanding stock in the hands of the public being that of the American corporation. The Canadian subsidiary has been the operating company, with direct ownership of the operating properties in Ontario, embracing mines, smelter, and refinery, only the rolling mill at Huntington, W. Va., and the foundry at Bayonne, N. J., being under the direct management of the American company. The new plan, which is outlined in a letter to stockholders just released, practically reverses the relations of the two companies.

The capital structure of the International Nickel Company of Canada will be readjusted, according to the plan, so that that company can exchange one share of 7 per cent cumulative preferred stock for each share of 6 per cent noncumulative preferred stock of the New Jersey company now outstanding. The issue will be non-callable for five years, after which it may be redeemed at $120 and accrued dividends. Also, common stock of no par value will be issued by the Canadian company, six shares being given in exchange for one share of the $25 par value stock of the New Jersey company offered for exchange on or before Nov. 30. In the interim, before the new stock is available, negotiable transfer certificates will be issued, for which arrangements will be made for listing on the New York, Montreal, and Toronto exchanges. It is planned, also, to have the same trading facilities extended to the new stock. The officers and directors of the present American company will have equivalent positions with the new Canadian company. No exact statement is made as to the amount of stock that it is proposed to issue, but the following statement is significant: "The capitalization of the Canadian company may be increased pursuant to due corporate action in the event that it is determined that the best interests of the company require the issue of additional stock in furtherance of the company's present rapid development and growth."

The letter further states that a "substantial ownership in the company has recently been acquired by Canadian investors who are, to an increasing degree, evidencing their interest and faith in the company's properties and management." The new arrangement is held to be to the advantage of all stockholders, both preferred and common. "It is believed that under the new capital structure now contemplated there will be opportunity to effect material savings, promote profitable expansion and substantially increase earnings."

It will be noted that not a word is said about any consolidation with the Mond company, its neighbor in the Sudbury district, and the only other important nickel producer in the world, though reports of such a merger have been numerous; nor can any official information be obtained on the subject. However, the way seems left open for such a consolidation after the present plan has been accepted by the stockholders. A Toronto report is to the effect that shares of the International Nickel of Canada may be offered for Mond securities, giving present International Nickel (of New Jersey) stockholders about 11,250,000 shares, and Mond stockholders about 2,500,000 shares in the new company. Such a plan may be in the air, but anything official can hardly be expected until the present reorganization is effected.

A consolidation of the International and Mond companies would probably be to the interest of both companies, and would be particularly efficacious in solving mining problems. The Frood orebody, which has occasioned all the excitement among nickel shareholders in the last two or three years, has three branches at the surface, one of which is owned by the Mond company. These branches coalesce at depth, forming one continuous orebody in the shape of a flat, steeply dipping lens, similar to the Creighton orebody, for years the standby of the International company. The property lines at depth give about a quarter of the length of this lens to

Mond and the rest to International. Mond's shaft is in the hanging wall, cutting the lens of ore at about the 2,000 level, a poor location from the standpoint of economical ore extraction. International's new shaft is in the footwall, a vertical shaft from which the ore dips away, and from which the entire orebody could be economically stoped.

No official figures are available as to the extent of this new orebody, but intelligent opinion indicates that slightly over 100,000,000 tons has so far been developed. No particular effort is being made to prove ore below the 3,000 level. The grade, also, has not been divulged, but it can be said to be variable. Near the surface, where the lens is very thick, it will average perhaps 1½ per cent each of nickel and copper, but below the 1,000 level, where the lens thins out and the dip becomes flatter, higher grade ore is obtainable, especially with regard to the copper content. There are many very rich spots, but it is unlikely that the ore that will be mined at the start, anyway, will run much over 2 per cent nickel and 4 per cent copper.

The vertical shaft, which is capable of handling 10,000 tons a day, has now been completed to 3,000 ft., and crosscutting is in progress which, in a few months, will tap the ore at the 2,000, 2,400, and 2,800 levels. Mining is not likely to start for about a year, though the surface plant at the mine is practically completed. The first unit of the concentrator is under construction; it will have a capacity of four or five thousand tons a day, but a part of this ore supply will come from the Creighton mine. After grinding, the ore will probably be tabled to remove a large proportion of the mineral in a reasonably coarse condition. The tailing will then be floated. No selective flotation will be possible, as the nickel, iron, and copper are closely associated even in the finest particles. Eighteen new roasting furnaces will be provided, supplementing the four now in use; and three new reverberatories, in addition to the one now in service.

Consolidated M. & S. Buys Saskatchewan Nickel Claims

CONSOLIDATED Mining & Smelting has taken over the Hall claims at Rotten Stone Lake, 75 miles north of Lac La Rouge, Saskatchewan, Canada. The claims, totaling about 790 acres, carry nickel, copper, and some gold, silver, and platinum. Supplies and equipment for a diamond-drilling campaign are being transported to the property by airplane.

A new schedule of payment for zinc ores shipped to its Sullivan plant was recently announced by the Consolidated company. The new rates represent an average gain to the shipper of about $1 a ton on average-grade concentrates, which is about 45 to 50 per cent zinc. This innovation is in accord with the company's policy of sharing with its patrons savings effected by advances in metallurgical treatment.

Smuggler Union Will Shut Down in December

SMUGGLER UNION MINING will shut down its mine and 800-ton mill at Telluride, Colo., about Dec. 1. The last annual report of the company stated that "unless exceptionally better results are had from the limited development now going on, active operations must cease with the exhaustion of ore reserves." This situation has arrived, according to Robert Livermore, president and general manager of the company. About 300 men will be thrown out of work by the closing of the mine, which is a producer of silver, lead, and gold. A complete description of the property by Mr. Livermore appeared in *Engineering and Mining Journal* of March 31, 1928.

A 400-Mesh Wire Sieve!

A WIRE SIEVE of 400 meshes to the linear inch, or 160,000 apertures to the square inch, is now in constant use at the Intermountain Station of the U. S. Bureau of Mines at Salt Lake City. This screen is an achievement in fine manufacture, for which credit is due to the Newark Wire Cloth Company, of Newark, N. J. The wires in this screen are 0.001 in. diameter, with openings 0.0015 in. wide. Previous to the introduction of this screen a few months ago the 325-mesh sieve was the finest available.

How to Be Elected State Mine Inspector

ANNIHILATING the enemy is an effective measure in war, and so performing one's duties in a political office that opponents are lacking at elections is an equally successful method of procedure for state mine inspectors. At least, so it would appear from recent press reports to the effect that Mr. Stewart Campbell, state mine inspector of Idaho, will be re-elected without opposition, as the Democratic nominee has resigned, and the Socialists have made no filing. Further, the last day on which vacancies on the various party tickets could be filled has passed.

Idawa to Use Flotation

Installation of a flotation unit is planned by Idawa Gold Mining at its Belshazzar mine, near Quartzburg, in the Boise Basin, Idaho, according to a report by S. M. Ballard, manager. The company has recently been treating tailing by flotation, and the trial has proved so satisfactory that installation of a permanent unit has been decided on. Development of the mine is progressing satisfactorily. Because of transportation difficulties, the entire production of concentrates during the winter will have to be stored and shipped in the spring.

Soviet May Build Zinc Plant on Dnieprostroy

AT THE last meeting of the Russian commission on protective consumption of the Dnieprostroy power, a project for the erection of a zinc-smelting plant, where most of the Russian zinc ores can be smelted, was suggested, according to the U. S. Department of Commerce. Although the principal locations of the mines carrying complex zinc ores are in Altai, Trans-Baikalia, northern Caucasus, and the Ural Mountains, smelting can be effected near the Dnieprostroy River. Ordinary smelting of complex ores for copper, as practiced at present, results in the loss of the other metals. Introduction of cheap electric power will allow selective flotation. Further discussion of this project has been postponed until the next meeting, when the opinion of Glavmetal (the metal sections of the supreme economic council) will be considered.

Calumet & Hecla Installs New Hoist at No. 17 Shaft

At Calumet & Hecla Consolidated's No. 17 shaft, Osceola amygdaloid branch, in the Michigan copper district, a force of men is installing a new hoist. Another crew is building a railroad spur to the shaft from No. 16. Reopening of No. 17 will be effected in the near future.

Sullivan Zinc Plant Produced 200 Tons to Oct. 19

The new electrolytic zinc plant of Sullivan Mining, near Kellogg, Idaho, has reached a production rate of somewhat over half its daily rated capacity of 60 tons. On Oct. 19, 1928, production was 34 tons per day of 99.99 per cent zinc. The first zinc was produced on Oct. 8, 1928, and amounted to ⅓ ton. Total production to and including Oct. 19 was 202⅓ tons.

Construction Work Progresses at Basin Montana Tunnel

RECENTLY a transformer to step down the current from 66,000 volts to 2,200 volts was installed at the property of Basin Montana Tunnel, in Jefferson County, Mont., by the Montana Power Company. The compressor house has been completed, and electricians are now wiring the camp and mining buildings, as the machinery will be installed soon. According to Samuel Barker, Jr., managing director of the company, 25 men are now employed on the Grey Eagle claim, driving two tunnels to tap the orebodies.

One of these tunnels is a new one, and at a point 175 ft. from the portal it struck 6 ft. of quartz, of which 3 ft. is said to be high-grade ore. This is now being drifted on. The old 400 tunnel level has been cleaned out for a distance of about 500 ft.

Surface views at the Hill Top mine in the Sheeprock Mountains of Utah

Hill Top Mine Is Shipping High-Grade Ore

REGULAR shipments of high-grade lead carbonate ore are being made from the property of Hill Top Mining, in the Sheeprock Mountains, 93 miles southwest of Salt Lake City and 30 miles northwest of Eureka, Utah. The ore is moved 15 miles by automobile truck to Dunbar, where it is loaded into railroad cars for transport over the Union Pacific lines to the Tooele plant of International Smelting.

A total of 814 acres, including seven patented claims that comprise the old Sultana mine, is controlled by the Hill Top company. During the last year the Sultana tunnel, through which the property has been worked periodically since 1888, was extended from the 500-ft. point to a distance of 1,000 ft. from the portal. A 75-ton gravity-concentration mill has been erected, and a 125-ft. shaft sunk on the western part of the property. Transportation from the shaft to the mill is effected by a 2,400-ft. tramway and a 900-ft. 5x7 ft. tunnel, which were completed at the same time.

Watercourses were encountered in extending the Sultana tunnel, and the drainage thus provided permitted the working of ore deposits above the tunnel level. The ore being shipped is coming from these workings, which are reached by an inclined raise driven from the 1,000-ft. point of the tunnel. Pockets of high-grade ore have been found in caves in this section of the property, the dimensions of which vary, but the maximum size is 100 ft. long by 40 ft. wide by 10 ft. high. Considerable low-grade milling ore has also been found in the lining of the caves. In extending the tunnel small deposits of low-grade lead-silver ore were encountered about 800 and 900 ft. from the portal. The company plans to work these deposits toward a limestone contact 200 to 250 ft. distant.

An outcrop of lead carbonate ore was followed in sinking the shaft; this changed to a sulphide ore carrying considerable silver at that depth. Further development of the vein and sinking of the shaft were halted by a heavy flow of water. Extension of the Sultana tunnel is expected to drain this section of the property and permit sinking.

Equipment in the mill includes a crusher, two sets of rolls, and five Wilfley tables. A 40-hp. steam plant supplies power. Operation of the mill has been suspended pending the outcome of flotation tests on the ore. If successful, the company plans to add a flotation unit to the milling plant. A three-drill compressor unit driven by a Fordson engine is used at the property. Operations are in charge of O. P. Clark, general foreman.

Officers of the Hill Top Mining Company, all of whom reside in Tooele, Utah, are: Parley Theuson, president and general manager; Frank G. Eastman, vice-president; and Kate Theuson, secretary-treasurer.

Mining Exhibits Displayed at Utah State Fair

ONE of the most impressive exhibits by the mining industry was that at the Utah State Fair held recently in Salt Lake City, the principal contributors to which were the mining and smelting companies in the district, the Intermountain Station of the U. S. Bureau of Mines, the department of mining and metallurgical research of the University of Utah, and the mining committee of the Salt Lake Chamber of Commerce.

A large sign effectively displayed, and bearing the caption "This Is What Mining Means to Utah," greeted the visitor at the entrance to the exhibit. Authentic statistics on the sign proved the importance of mining to the state. Exhibits by the Intermountain Station and the department of mining and metallurgical research of the University of Utah attracted considerable attention. These comprised displays devoted to mineral statistics, microscopic research, flotation, crushing and grinding, assaying and smelting, and first-aid, and mine rescue. Beyond these exhibits were those of the individual mining and smelting companies. The visitor, by means of photographs, samples of products, charts, and various models, was able to obtain an accurate picture of operations at Utah's leading mines.

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Bagdad Copper Constructing Experimental Plant

BAGDAD COPPER is building an experimental plant of 50 tons' capacity at its property at Hillside, Ariz. A 50-ton flotation mill, a roasting plant to roast the concentrates from the mill, and an agitator in which the copper from the calcines will be dissolved have been erected. Orders have been placed for the machinery for an electric precipitation plant which will have a capacity of 1,500 lb. of copper a day. Acid solution will be used to dissolve the copper from the calcines in the agitator and the metal will then be precipitated out into the electrolytic plant. An experimental leaching plant having a capacity of 10 tons per day, designed to handle carbonate ore, is being installed.

Electric power is generated at the property by means of two Diesel engines of 360 and 75 hp. respectively. The company is also installing a 180-hp. Diesel engine to be directly connected to a 2,000-amp. 50-volt d.c. generator.

Two New Companies Formed to Operate Oregon Mines

ROGUE RIVER GOLD, incorporated in Oregon, has taken over the new gold dredge on Foots Creek at Gold Hill, Ore., recently constructed and completed by Ludlum Engineering, of New York. This project cost approximately $500,000 to equip and put into operation. It includes a dredging area of 2,600 acres. Officers of the company include O. B. Perry, San Francisco, president; E. M. Cooke, New York, vice-president; D. H. Ferry, Gold Hill, Ore., vice-president, secretary-treasurer, and manager.

Seattle Mining, also an Oregon corporation, has acquired the War Eagle quicksilver mine, near Gold Hill. The property consists of 525 acres of mining ground. It is equipped with a 30-ton Scott furnace as well as a 12-pipe quicksilver retort. Extensive ore development is under way. J. M. Dey, of Seattle, is president and C. S. Bertleson, of Medford, Ore., is secretary-treasurer. Mr. Bertleson was the head of a group of lienholders who took over the property in June after it was involved in litigation under the ownership of Medford Refining & Reduction.

Seneca Copper Prepares for Reopening Mine

OPERATIONS will be resumed on a large scale at Seneca Copper, in the Michigan copper district, as soon as an organization can be built up. The company, which shut down its mine in June, 1927, has started to put on a working crew. At the time of its closing, the mine employed about 300. It is believed that no preliminary work will be necessary, as the physical condition of the property is good. Pumps have been kept in continuous operation, and the workings are free of water. Although the company already has about seven miles of drifts, a vigorous program of development will be started to provide sufficient stoping area for production on a large scale.

The Seneca mine is well equipped. No. 1 shaft probably is the most modern in the district. It is lined with reinforced concrete on all four sides for 1,321 ft. down to the curve where the shaft intersects the Kearsarge lode. From the curve downward, the shaft is under and parallel with the vein for a distance of 1,519 ft. It is a three-compartment shaft. The rock house is a frame structure, and will have to be replaced eventually. According to the present plans of the company, this shaft will be sunk an additional 1,000 ft. and four levels opened, north and south. No. 8 and No. 9 levels will also be extended further.

No. 2 shaft is concreted on all sides, from surface to bedrock, a depth of 400 ft. At the No. 3 level, the shaft is "holed through" to connect with the drift from No. 1 shaft.

Transportation Delays Hold Up Luiri Mill Operations

Delays in transportation of the equipment of the treatment plant have postponed the start of productive operations at the Matala Hill mine of Luiri Gold, in Northern Rhodesia, according to H. C. Hankins, secretary of the company. The plant will treat 50 tons a day at the start. Development of the mine during the quarter ended Sept. 30 proceeded rapidly, a total of 529 ft. being driven. Most of this work was done on the 100 level east of the No. 5 shaft. Results ranging from 1.5 to more than 20 dwt. per ton have been obtained on this level.

Independence Mine Optioned

After having been developed on a small scale, the property of Independence Copper-Gold-Silver Mining, situated about 13 miles south of Deer Lodge, Powell County, Mont., has been optioned to Daniel L. Lewis and associates, of New York. This property was first discovered in 1870. It has been developed by several shafts and tunnels, one 550 ft. long. Except for a small production of gold in 1920, however, it has been idle for a long time.

U. S. Supreme Court Upholds Decision in Favor of Carson

ANACONDA Copper Mining has been denied the right of having the case brought against it by the Carson Investment Company reviewed before the U. S. Supreme Court. This verdict, which means that the decision of the district court in favor of Carson Investment will stand, was handed down on Oct. 22. The suit against Anaconda was one of several brought against copper-smelting companies for alleged infringement of the Carson patent on the side-feeding of a reverberatory furnace. The litigation has been carried on continuously since 1925, when Carson obtained a favorable verdict in the California federal courts. In its appeal to the Supreme Court, the Anaconda attorneys were headed by Charles Evans Hughes, former Secretary of State.

Important Development Work Planned at Copper Queen

ACCORDING to an announcement made by J. P. Hodgson, manager of the Copper Queen branch of the Phelps Dodge Corporation, an extensive development program, extending over a period of four years, has been planned for the properties in the Bisbee district of Arizona. Mr. Hodgson's statement said that, "During and since the war the reserves in the Copper Queen mines have gradually diminished, largely because of the fact that no extensive campaign of development work had been inaugurated and made effective. The present plan calls for a very thorough exploration of the property. It is expected that this additional work will provide employment for between 200 and 300 men." Work will probably not be started on this program until the end of the year, as additional new equipment must be ordered and delivered.

This new program is in addition to the development work that has been going on in the southern part of the Bisbee district, which has been proceeding for the last two years and which includes sinking the Warren shaft. This shaft is now 2,250 ft. deep, and a sump and pump station are being cut at that level.

Will Treat Tailing Dump at Guadalupe, Zacatecas

ABOUT 4,000,000 tons of tailing on a large dump at Guadalupe, near Zacatecas, State of Zacatecas, Mexico, will be treated under the direction of Albert Delissalde, mining engineer. The process that will be used has already been successfully worked in Pachuca by Mr. Delissalde's father. An examination of the deposits by engineers of Real del Monte, a subsidiary of U. S. Smelting Refining & Mining, is reported to have given an average assay of 104 grams silver, ½ gram gold, and 350 grams quicksiver to the ton.

Experiments undertaken on tailing dumps at Guanajuato some time ago by representatives of the Seeley Mudd estate are said to have been satisfactory, and about 75 tons of material is being treated daily. There are about 300,000 tons of tailing on the dump.

Mexico Consolidated to Increase Mill Capacity

F. C. EMERY, president and managing director of Mexico Consolidated, has announced that he will let a contract before the end of 1928 for increasing the capacity of the Verna mill, at Noria, Sonora, Mexico, to 300 tons daily. The Verna silver-gold mine has at this time more than two miles of underground development work, and it is felt by the management that this amount of development warrants enlarging the mill, which has a present capacity of 50 tons. Production from the mine has amounted to 422,000 oz. of silver and 1,500 oz. of gold during the first six months of 1928.

In addition to the Verna property, Mexico Consolidated owns the Maravilla, about three miles south of the Verna, on which it is proposed to build a 50-ton cyanide plant, and the Ajax, San Ignacio, and Santa Gertrudis, about four miles southeast of the Maravilla. Lead and copper are also found in the ore at the last three properties named.

Company Formed to Operate Peerless Mine, Near Juneau

Marty Consolidated Mines has been organized to operate the Peerless mine, at Windham, south of Juneau, Alaska. This property is equipped with a 100-ton mill and a hydro-electric plant. Ore is conveyed from mine to mill by a tramway, 4,400 ft. in length. The ore occurs in lenses along a fissure traceable for 2,000 ft. Geological conditions are said to be similar to those at the mines of Chichagof Island.

La Leona Shaft Completed

Majestic Mining has completed the new working shaft at its La Leona mine, in the Totalapam district of Oaxaca, after sinking for the last four months. The company is now cleaning the workings on the No. 4 level of the mine, preparatory to starting the mill, which was finished several months ago. H. J. Filsinger, superintendent in charge of operations, reports that the property should be working at capacity within two months. The company has its head offices in Kansas City, Mo.

African Copper Production May Reach 300,000 Tons Annually by 1935

Raymond Brooks, at a Joint Meeting of the A.I.M.E. and Mining and Metallurgical Society, Analyzes Production Possibilities as Disclosed by Developments at Northern Rhodesian Properties

By Homar L. Johnson
Assistant Editor

AT A JOINT MEETING of the New York section of the A.I.M.E. and the Mining and Metallurgical Society of America, held on Wednesday evening, Oct. 24, at the Harvard Club, Raymond Brooks, formerly general manager of Rhodesian Congo Border Concession, estimated the annual production of copper from South Central Africa at 300,000 metric tons by 1935. Mr. Brooks, the principal speaker of the evening, dwelt on the "History and Present Position of Rhodesian Copper Development."

Following the customary informal dinner, Sidney Rolle, chairman of the New York section, acting in the absence of Colonel P. E. Barbour, turned the meeting over to Clinton Crane, president of the M. & M. Society, who introduced the speaker of the evening with a brief mention of his experience and exceptional fitness to discuss the subject of Rhodesian copper.

Mr. Brooks at first explained the geography and relative location of the various properties and concessions in Central Africa, punctuating his talk with frequent references to large-scale maps of the area. A historical résumé of the early exploration and development of the copper deposits on both sides of the Belgian Congo - Northern Rhodesia border was given. Inception of the plan to explore the vast area south of the Congo border in the minds of A. Chester Beatty, Minerals Separation, Ltd., and associates, was recounted.

The granting of government prospecting concessions and subsequent formation of Rhodesian Congo Border Concession, Ltd., resulted in Mr. Brooks' assuming the management and development of one of the largest prospecting organizations in the history of mining. (Details of this organization, its activities and methods of operating, are contained in the published account of an interview with Mr. Brooks by A. B. Parsons in *Engineering and Mining Journal* of June 11, 1927.)

Present annual production from the Congo-Rhodesian area consists of about 110,000 metric tons from Union Minière and 6,000 metric tons from Bwana M'Kubwa, the oldest property in Northern Rhodesia and the only producer at present.

Concerning future production from Africa, Mr. Brooks ventured the opinion that Union Minière would reach an annual production of 150,000 metric tons of copper within the next two years, 30,000 tons of which would be from the leaching plant. The additional 50,000 metric tons needed to fulfill estimates of Union Minière's 200,000-ton potential productive capacity will not be forthcoming until the western mines are developed and plants built, which, in Mr. Brooks' opinion, will not take place until after 1935. The probability that production of copper from Rhodesian mines will equal that of their neighbors across the Congo border in the next six years is very good, and Mr. Brooks estimated the components making up such an annual production, in metric tons, as follows: Bwana M'Kubwa, 12,000; Roan Antelope 45,000; N'Kana, 45,000; N'Changa, 45,000—aggregating in round numbers an equivalent of 150,000 metric tons, thereby making the African contribution to the world copper production at the rate of approximately 300,000 metric tons by 1935.

RAYMOND BROOKS

The four Rhodesian properties mentioned are situated along the present railway extending southeast from Elisabethville. The area west and south of the railroad and the Rhodesia-Congo border is described by Mr. Brooks as an area in which evidences of copper mineralization are more widespread than in any corresponding area of any other known country. Production from this region is not a probability of the near future, however. Within another ten years the world market should be able to absorb an addition of several hundred thousand tons to the yearly production total from this source without demoralization of the market or destruction of the copper-producing industry elsewhere. An interesting feature of the meeting was the exhibition of moving pictures taken by Mr. Brooks during his most recent visit to Rhodesia and South Africa.

Dr. Otto Sussman contributed an interesting discussion on the geology of the Rhodesian ore occurrences, and especially those of the Roan Antelope deposits. Particular reference was made to the differences in occurrence, mineralogical composition, and apparently in genesis, between the ores of the Belgian Congo and those of Northern Rhodesia, regardless of their close geographical association. That Northern Rhodesia presents great opportunities for the metallurgist has been remarked, and Dr. Sussman ventured the opinion that the geologist would find the district equally interesting. An estimate of the cost of producing copper from the Roan Antelope property has been worked out by the company's staff and is not far from 8c. per pound for "Best Select" copper delivered in London, considering metallurgical losses, but before deducting for depreciation or income-tax allowances, according to Dr. Sussman. Supplementing the Northern Rhodesian copper discussion, A. W. Newberry presented a series of colored lantern slides descriptive of chrome, asbestos, go'd, and other mining operations in Southern Rhodesia.

Announcement was made of the resignation of Colin G. Fink as treasurer of the New York Section of the A.I.M.E. because of illness and of the appointment of A. B. Parsons, of the executive committee, to serve in that capacity for the remainder of the term.

Anaconda Is Reopening Its Badger State Mine

OPERATIONS at the Badger State mine of Anaconda Copper, in the Butte district of Montana, were resumed on Oct. 22. According to James R. Hobbins, vice-president in charge of operations at Butte, approximately 600 men will be employed when capacity operation is reached. The Badger State has been closed since March, when a fire broke out, killing three men. Work of cleaning up and repairing the levels should be completed within a short time. Normal production from the Badger, previous to its shutdown, was about 1,000 tons of ore daily. The mine is equipped with a large electric hoist, similar to the hoists at the Mountain Con and Belmont mines of Anaconda.

New Gold Strike Reported in Southern Rhodesia

A recent dispatch to The Associated Press announces the discovery of gold at Beacon Hill, near Gobo, Southern Rhodesia. The discovery is reported to be in a quartz formation, and the customary statements of extraordinary richness characterize the report. That gold exists in the region mentioned has long been known, Southern Rhodesia's production being valued at £1,878,027 in 1926. The announcement therefore suggests the possibility of an expansion of commercial development that may compensate in some measure for the decrease in production of some of the older mines of the Rand.

Bradley Discusses Treadwell Yukon

Profits at Errington Mine Expected to Average About $5 per Ton—Property Presents New Problems in Mining and Smelting Complex Ores—Tybo and Wernecke Progress

F. W. BRADLEY, president of Treadwell Yukon, in a recent interview with a representative of *Engineering and Mining Journal,* made the following statements with regard to the future of the company:

"At the Wernecke property three additional mining options have been taken over. Although these properties will require equipment and development in the immediate future, there will be a profit from these operations each year. At Tybo, Nev., we expect to have the new concentrating plant installed and in operation in March, 1929. This will place this property on a producing basis.

"At Sudbury under present conditions there is every reason to think that the average ore grade of the Errington mines will compare closely with the average of the diamond-drill hole results, which was $18 per ton. As a result of mining operations and experimental milling work on a commercial scale, we can see a profit of $5 per ton upon ore of this average grade. There is no reason to think that we will not get this average grade of ore. A combination of the ore produced from the three shafts will make the average ore grade when mining is extended over a larger area. The product of different stopes will maintain the average grade more nearly than can be done under the present limited operation.

"From a mining viewpoint the situation underground is absolutely new. The diamond-drill holes gave the initial key to the situation. Both in area and in depth the volume of ground to be explored and developed is exceptional. The deepest diamond-drill hole extended to a vertical depth of 800 ft. It is going to take time to develop this great ore zone. Likewise, it is necessary to accumulate mining experience in the habit of the orebodies. At the Bunker Hill & Sullivan mine, where we have been mining for 40 years, each new level is a distinct mining problem, and although our past experience and our maps indicate trends of the orebody, new features develop upon each new level, and these have to be worked out before the development of a new level can be completed. The Errington mine presents a similar problem, and the management of this property is busy acquiring its mining experience.

"At No. 1 shaft three separate orebodies are being stoped on the 300 level, but very little exploratory work is being done at this level where ore in advance of immediate needs has been developed. On the 500 level of this shaft a crosscut is being extended, but it has not yet reached the veins. As stated some time before, approximately 1,000,000 tons has been developed on the 300 level.

"At No. 2 shaft development is altogether on the 500 level. The main crosscut was extended about 1,300 ft. and intersected four veins in a zone 480 ft. wide. The veins are respectively 61, 60, 65, and 49 ft. in width. Our job is to explore the four veins east and west and over their entire width. The veins are quartz carbonate filling which has been in part replaced by the ore sulphides, and we have yet to learn whether there is any preference exhibited by the orebodies for one or the other of these veins, or for any particular position within them. The geological conditions controlling these replacements are being determined as exploration advances. Drifts are being extended and long-hole drills are being used to explore the vein widths from the drifts.

"At No. 3 shaft, 11,000 ft. east of No. 2, the shaft has been sunk to the 400 level, a station cut and the crosscut started toward the vein, which is 1,140 ft. away.

"At the pilot mill two ball mills are operating, which brings the capacity up to 300 tons per day, but there has been no incentive to use this capacity during the experimental stages. Additional equipment in flotation cells is being added as the needs for use develop. The milling problem has been solved, but there yet remains the work of perfecting it; that is to say, making the best possible extraction under such operating conditions as will yield the maximum return from the ore."

Herbert Hoover Is Awarded John Fritz Medal

THE John Fritz gold medal, the highest honor bestowed by the engineering profession of this country, has been awarded for 1929 to Herbert Clark Hoover. "The choice of Mr. Hoover," according to the announcement by Alfred D. Flinn, director of the Engineering Foundation, "ended a process of selection begun a few years ago. The award was tentatively made a year ago by the John Fritz Medal Board, which is composed of sixteen recent past-presidents of the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers, having together a membership of nearly 60,000.

"By this award, which was unanimous, the board sought to express the high appreciation of Mr. Hoover's professional brethren for his distinguished attainments as an engineer, particularly in mining operations in this and other countries, and his great services as a man to his fellows.

"Notable among his engineering achievements are the successful introduction into other countries of improved American mining methods. His scholarly accomplishments are also worthy of mention, especially his translation into readable English from difficult medieval Latin of Agricola's famous book, 'De Re Metallica.' Mrs. Hoover was associated with him in this enterprise, which occupied 'leisure' hours at one period some years ago."

The citation accompanying the award reads:

"To Herbert Hoover, Engineer, Scholar, Organizer of Relief to War-Stricken Peoples, Public Servant."

The medal, a memorial to the late John Fritz, of Bethlehem, Pa., long a leader in the American iron and steel industry, will be presented to Mr. Hoover at the annual meeting of the A.I.M.E. in February, 1929, at New York.

During recent years Mr. Hoover has been made an honorary member for life of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the A.I.M.E.

Bradley Nominated for President of A.I.M.E.

Frederick W. Bradley, of San Francisco, president of Bunker Hill & Sullivan and of Alaska Juneau, has been nominated for president of the A.I.M.E. by the nominating committee, according to a report of the committee by Galen H. Clevenger, chairman. Other nominations include Edgar Rickard, mining engineer, of New York, and H. A. Buehler, state geologist of Missouri, for vice-president and director; and F. W. Paine, vice-president of Copper Range, Boston, Mass.; Harvey S. Mudd, mining engineer, of Los Angeles; Eugene McAuliffe, president of Union Pacific Coal Company, Omaha, Neb.; Erle V. Daveler, general manager, Butte & Superior, Butte, Mont.; and William R. Wright, mining engineer, of Chicago, for directors.

United American Deepens Shaft to 1,200 Ft.

Shaft sinking of the main shaft at United American Mining, which adjoins the Tom Reed mine, in the Oatman district of Arizona, was started recently from the 700 level, with the 1,200 level as the objective. On reaching this point, lateral work will be started with the idea of exploring the extension of the Aztec vein, on which several discoveries have been made in Tom Reed territory. W. K. Ridenour, of Los Angeles, is president and general manager.

East Kootenay Power Obtains Additional Rights

East Kootenay Power, which supplies electric power for the operation of the Sullivan mill of Consolidated Mining & Smelting, at Kimberley, B. C., has been granted additional power rights on the Elk River. The capacity of its hydro-electric stations will be increased by an additional 15,000 hp.

Kootenay King Is Optioned by Britannia Mining & Smelting

AN OPTION has been taken by Britannia Mining & Smelting, Howe Sound's British Columbia subsidiary, on a controlling interest in the stock of Kootenay King, which has been developing 22 claims 12 miles northeast of Fort Steele, B. C., and 10 miles from the Sullivan mine of Consolidated Mining & Smelting. Terms of the deal have not been announced. Britannia has taken control of the development work and has sent a crew of men to construct a winter camp.

Development work at Kootenay King has followed plans laid by J. M. Turnbull, professor of mining at the University of British Columbia and formerly associated with Consolidated Mining & Smelting. Recent drilling has indicated widths of silver-lead-zinc ore ranging from 27 to 70 ft. The ore deposit is described as a replacement deposit in the Aldridge quartzite, similar to the ore of the Sullivan mine, but the grade of ore found to date has been higher than the average Sullivan grade. Minerals occurring with the galena and sphalerite are chiefly pyrite and pyrrhotite.

The property is at an elevation of about 7,000 ft. and is reached from Fort Steele by 6 miles of wagon road and 6 miles of pack trail. Development will be continued through the winter.

Tungsten Plant Will Be Built at Globe

CONSTRUCTION of a 50-ton capacity tungsten roughing plant at Sulphide Del Rey, in the Pinal Mountains, south of Globe, Ariz., is planned by the E. C. O'Brien Company. The company owns 25 claims at Sulphide Del Rey. A 25-ton capacity tungsten-cleaning plant will also be built at Globe, which will handle the product from the roughing plant as well as consignments from small producers in the district.

Tungsten concentrates must average 60 per cent tungsten before they will be accepted by Eastern purchasers, and a shipment of less than a carload is not practicable. After the cleaning plant is built, activity on the part of many small producers should be stimulated.

Extensive Drilling Program Planned for N'Kana Tract

ROAN Antelope Copper Mines, Ltd., and Rhodesian Selection Trust, Ltd., have awarded contracts to E. J. Longyear Company, of Minneapolis, Minn., for an exploratory drilling campaign on the N'Kana Concession in Northern Rhodesia. A large amount of drilling is planned, with holes not to exceed 2,300 ft., within the Concession, which is 1,800 square miles in area.

The contracts call for nine complete diamond-drill outfits to be shipped from this country, with a crew of 35 drill men and foremen. Several drill helpers will be recruited in England, and black labor will be secured locally. Part of the equipment has already been shipped, and work will begin immediately upon the arrival of the first group of operators.

Campbell Orebody at C. & A. Continues Below 2,200 Level

CONTINUATION of the Campbell orebody, at Calumet & Arizona's property in the Bisbee district of Arizona, below the 2,200 level has been proved by diamond drilling. At a point 65 ft. below the 2,200 level, which was the deepest point that development had previously reached, a drill entered 6 per cent ore and continued in it for 40 ft.

Work of developing the Campbell orebody has been in progress for the last two years. A considerable amount of high-grade ore has been opened on the 2,200 level of the Campbell shaft. On the 1,800 level, the ore zone has been penetrated for 800 ft. Some stoping is being done on the 1,800 level to increase the average grade of the ore output, as in this section it is better than in the older workings of the mine.

Operations to Be Suspended at Tajo Mine, in Sinaloa

PREPARATIONS are being made to suspend operations at the properties of Minas del Tajo, situated at Rosario, State of Sinaloa, in Mexico. This mine, which has been operating for the last 50 years, is one of the largest silver-gold properties in Mexico. It is controlled by the Bradbury estate, of San Francisco, which also owns the Bolanos property, near the border separating Jalisco and Zacatecas.

Development of the Tajo mine has reached a depth of 1,100 ft., and more than 92 miles of workings have been driven. A 300-ton cyanide plant treats the ore. The company employs about 650 men in the mine and mill.

Asbestos Mines in Arizona Are Increasingly Active

ACTIVITY in the mining of asbestos in Gila County, Ariz., is increasing. At Chrysotile, Johns-Manville is employing 150 men and producing 80 tons of asbestos per month. The Regal Asbestos Company, in the same district, is shipping 55 tons per month and is employing 100 men. The product sells in the Eastern market at from $420 to $625 per ton.

The firm of Lunn & Matthews, of Globe, announces that it has sold control of its Bear Canyon asbestos property to Dr. R. V. Mattison, of Ambler, Pa. This property consists of twenty claims, 21 miles north of Rice and 3½ miles from the Rice-Springerville highway.

Dr. Smith Speaks at Meeting of Tri-State Producers

OVERPRODUCTION is an evil that harasses most branches of the mineral industry, Dr. George Otis Smith, Director of the U. S. Geological Survey and president of the A.I.M.E., told mine operators of the Joplin-Miami district at the recent sixth annual meeting of the Tri-State Zinc & Lead Ore Producers' Association. Declaring the Sherman Act was "out of date," Dr. Smith said that the mineral industries should be permitted to regulate their industries from within.

J. F. Robinson, Commerce Mining & Royalty; Frank Childress, Childress Lead & Zinc; F. N. Bendelari, Consolidated Lead & Zinc; Charles Neal, Domada Lead & Zinc; C. F. Dike, Interstate Zinc & Lead; A. M. Gaines, New Chicago Mines; George Potter, Eagle-Picher Lead; P. W. George, Federal Mining & Smelting; T. F. Lennan, L. & G. Mining; S. H. Davis, Century Zinc; W. T. Landrum, Cortez-King Brand Mines; M. F. Owens, Black Eagle Mining; George Pearson, Lawyers Mining; George Provine, Tulsa Lead & Zinc; and E. Z. Wallower, Evans-Wallower Lead, were elected directors for the coming year.

Dr. H. Foster Bain, secretary of the A.I.M.E., complimented the zinc miners on their efforts to co-operate to the end that the industry might be stabilized.

Annual reports of J. D. Conover, covering the zinc situation of the West; Fred Nesbitt, safety engineer; Mr. Neal, treasurer; and, Dr. F. V. Meriwether, director of the Tri-State clinic, were read.

Chief Consolidated Expects to Encounter Ore Soon

Sinking of the winze from the 900 level of the Tintic Bullion property, which is situated in the Tintic district of Utah and owned by Chief Consolidated Mining, had reached a depth of 125 ft. on Oct. 19. Three shifts are being worked, and sinking is averaging 7 ft. a day. At a depth of 310 ft. it is expected that the extension of the orebody mined in the adjoining North Lily property will be encountered. The sinking is being done by the Walter Fitch, Jr., Contracting Company.

Siscoe Mill Ready Dec. 1

According to John T. Torbutt, president of Siscoe Gold, in the Rouyn district of Quebec, the company's new mill and cyanide plant will be finished by Dec. 1. The power-house machinery is all on the ground, one of the two Diesel engines is installed, and electricity is being generated. Two large 70,000-gal. oil tanks have been erected, and the pipe line has been run to the landing dock. Southwestern Engineering is building the plant, which will be the first cyanide gold mill in Quebec.

MARKET AND FINANCIAL NEWS

American Smelting & Refining Company Plans Readjustment of Capital Structure

SIMON GUGGENHEIM, president of the American Smelting & Refining Company, has issued the following announcement concerning the proposed readjustment of the company's financial structure. The effects of these readjustments will be:

1. To split up the present outstanding common stock by exchanging the present par value common stock, amounting to 500,000 shares, par $100, for no-par-value common stock, on the basis of three shares of the latter for one share of the former.

2. To authorize an additional amount of no par common stock to the extent of 2,170,060 shares, not now to be issued, but to be available for prompt use by the company to meet its needs as the occasion may arise.

3. To authorize a second preferred stock, consisting of 200,000 shares of the par value of $100 each, with the aggregate par value of $20,000,000, entitled to 6 per cent cumulative dividends, subordinate to the present preferred stock, and redeemable or not as determined by the board of directors at the time of issue.

The report continues:

"Any progressive company should have its capital structure so arranged as to enable its board of directors to take prompt advantage of any opportunities that may arise for the expansion and proper financing of its business, and it is with this purpose in mind that your board of directors recommends the creation of the second preferred stock and the provision for having a considerable amount of common stock authorized and available for future issue.

"The provision for the second preferred stock should meet with the prompt approval of both preferred and common stockholders. Such stock can only be issued for either $100 per share in cash or its equivalent in property. Its issuance for the full amount would, therefore, place an additional $20,000,000 behind the present outstanding preferred stock and strengthen that stock proportionately. Nor would it detract from the value of the common stock, for the reason that not only must full value be received when the stock is issued, but also all earnings above 6 per cent inure to the common stock. The company's past history shows that its investments and undertakings have yielded more than 6 per cent, and it may, therefore, reasonably be assumed that the proceeds from the second preferred stock will have a similar history, either directly or indirectly.

"The desirability of splitting the present outstanding stock into three shares for one requires little argument in its support. Obviously, the earnings of the company have grown to such an extent that the market price of the common has become so high as to limit, in some measure, the proper reflection of the value represented by each share. The proposed split-up of the common stock, through the issuance of a greater number of shares, will enable a larger participation in its ownership, which will permit the proper reflection of its true value. A larger distribution of the stock among a greater number of people will also increase the friends of the company and tend to assist in its business progress.

"To carry the proposed changes in capital structure into effect, the law requires that two-thirds of the present outstanding preferred stock and also two-thirds of the present outstanding common stock shall each vote in favor of the plan. Should less than two-thirds of each class be present at the meeting, or, if present, less than two-thirds of each class vote in favor of the plan, it will fail of adoption."

A special meeting of stockholders of the company has been called for Dec. 18, 1928, at which meeting the adoption of the proposal will be decided upon.

Grasselli-Du Pont Merger Sanctioned by Government

UPON receipt of word from the U. S. Department of Justice to the effect that the proposed absorption of the Grasselli Chemical Company by E. I. du Pont de Nemours & Company might legally be completed, T. S. Grasselli, president of the first-named company issued an extensive announcement on the subject, from which the following is abstracted:

An agreement has been entered into between the E. I. du Pont de Nemours & Company and the Grasselli Chemical Company, having as its object a consolidation of the interests of the two companies. This agreement, if approved by the stockholders of the Grasselli company at a meeting to be called for Nov. 10, provides for the retirement of Grasselli's 6 per cent preferred stock on Dec. 3, 1928, at $110 per share plus accumulated dividends to Dec. 31, 1928. The Grasselli company will receive for subsequent distribution to its common shareholders common shares without par value of the du Pont company in numbers equal to one-fifth of the number of Grasselli's outstanding common shares without par value.

It is further understood that the combined heavy chemical business of the two companies will be carried on under the long-established name of Grasselli Chemical Company and that no important changes are contemplated in the present efficient administration of these activities.

The advantages to be gained from the combined technical knowledge and experience of these two great companies will result, in the opinion of those interested, in the more rapid development of the science of chemistry and its application to the industries of this country, and greater economies will be assured in the manufacture, sale, and distribution of chemical products.

Grasselli Chemical Company owns and operates zinc and pyrites mines and metallurgical plants in Virginia, West Virginia, Tennessee, and the Tri-State District, in addition to its strictly chemical manufacturing plants.

Evans-Wallower Lead to Issue Preferred Stock

A MEETING of the stockholders of the Evans-Wallower Lead Company was held in Joplin, Mo., on Oct. 17. The purpose of the meeting was to vote on a proposal to float a $1,250.000 preferred stock issue. The proposal was approved. Proceeds from the sale of preferred stock will apply on the construction of the company's Tainton-process electrolytic zinc plant to be erected at Monsanto, a suburb of East St. Louis, Ill. Stockholders will have the right to purchase one unit, consisting of one share of 7 per cent cumulative preferred stock and four shares of no-par common stock, at $102 per unit, for each 36 shares of common stock held.

President Edgar Wallower announced at this meeting that the most recent reports received from the electrolytic plant of the Sullivan Mining Company at Kellogg, Idaho, which uses the Tainton process, stated that the process was operating successfully in the production of exceptionally pure zinc at a low power rate, which could be considered as eliminating all doubt of the ultimate success of the proposed Evans-Wallower plant.

London Financial News

By W. A. Doman

London, Oct. 16, 1928.—An interim dividend of 15s. per share for 1928, as compared with 20s. for 1927, is announced by the Rio Tinto Company. This reduction was anticipated, it having been foreshadowed at the general meeting in May last that the company would have to make heavy payments to the Spanish government for tax arrears for the years 1922-25 inclusive. The directors add that the increase in the price of copper has not been fully reflected in the earnings, owing to a diminution of production from the smelter in Spain.

Proposals for a drastic reduction in capitalization accompany the report of the El Oro Mining & Railway Company of Mexico, for the year ended June 30. The mine has now closed down, so that this and other items stand in the balance sheet at fictitious figures. By reducing the capital from £1,147,500 in £1 shares to £286,875 in 5s. shares, the directors hope to give shareholders in the future "a fair return upon their capital out of the profits of La Noria Mine." Ore reserves are 287,023 tons, averaging 18.13 oz. silver, and, on a price basis of 58⅜c. per ounce, El Oro's 72 per cent participation in profits is expected to be £50,000 per annum.

Vast zones of potash beds have, I learn, been discovered in northeast Spain by the Director of the Spanish Geological and Mining Institute. The deposits, which extend along the Pyrenees through the provinces of Catalonia, Aragon, and Navarre, and probably Guipuzcoa, are said to be much richer even than those of Alsace-Lorraine.

The general manager of the India Copper Corporation—owning mining rights in Bengal, Chota, and Nagpur, and the 2s. shares and convertible debentures of which have been active in London—reports good progress during the first half of 1928. By developing 24,887 tons of 4.12 per cent ore during that period, reserves are brought up to 597,466 tons, averaging 3.94 per cent copper.

A revival of interest is promised in the various processes for the treatment of platinum ores during the next week or so, when the Runcorn plant of the Chemical & Metallurgical Corporation is due for its first "clean-up." I learn that this plant, which has been running for the last fortnight or more on concentrates received from Potgietersrust Platinums, Ltd. (Transvaal), is now having delivered to it regular monthly consignments of platinum ores. At the corporation's pilot plant in London a 95 per cent extraction was obtained, and even better results are anticipated from the Runcorn unit. When these are made known and details of costs are available, some comparison with the process of the Central Mining (Johannesburg) metallurgists, to which I referred a few weeks ago, will be possible. Cost figures for the latter process have not yet been disclosed, but, according to local advices, working costs should not exceed 36s. per ton. Taking this figure as a total charge, including mining, it would, at the current price of platinum, bring material containing 2½ dwt. within the definition of ore.

British colonial reports are notoriously slow in making their appearance, a fact which does not detract, however, from the interest of figures contained in the British Guiana Report for 1927, issued recently. The report points to the diversion of diggers from the gold areas to the alluvial diamond workings, which has resulted in a decrease in the gold output to 6,722 oz. The year's diamond output was 173,796 carats, obtained entirely from alluvial workings, mostly by individuals. The value of plant and equipment employed in the bauxite industry is estimated at around £1,000,000. The year's output of 160,933 tons, it is stated, places British Guiana in the forefront of bauxite producing countries. Apart from the Demerara Bauxite Company—a subsidiary of the Aluminum Company of America—which started operations in 1914, the British and Colonial Bauxite Company has recently taken up another large area. This new concern, which is a subsidiary of the British Aluminum Company and allied British and colonial interests, had not started active mining operations at the close of the year.

Domestic Tin Traders Organize

DOMESTIC dealers and traders in tin met recently and organized the American Tin Trade Association. The purpose of the association, according to the motion which marked its inception, is: "to promote the best interests of all concerned in the pig tin trade, to maintain just and equitable principles and established uniformity of commercial usage among its members; to provide and regulate a suitable room or rooms for the use of the association; to acquire, preserve, and distribute valuable business information; and to adjust controversies and misunderstandings in the trade by arbitration."

A. B. Hall, of the National Lead Company, was appointed chairman of a committee to draw up laws, bylaws, and rules of procedure whereby the association will be governed. Other members of the committee are: H. W. Starke, of Caswell & Starke; F. D. Shaw, of Gardner, Guitermann & Company; C. S. J. Trench, of C. S. Trench & Company; E. Vogelsang, of Lewis Lazarus & Sons of N. Y., Inc.

Fluorspar Duty Increased

On Oct. 17, an increase of 50 per cent in the duty on metallurgical grade of fluorspar was approved by President Coolidge. Details of the tariff commissions' report and findings will be published in next week's issue.

STATISTICAL NOTES

Andes Copper reports net income for the nine months ended Sept. 30, 1928, as $1,782,470 after taxes, depreciation, and interest. With 1,762,219 shares of no-par common stock outstanding, this is equivalent to earnings of $1.01 per share. Income from sales of copper during this period amounted to $8,136,498, and operating cost amounted to $3,514,639.

Texas Gulf Sulphur Company reports net earnings of $3,680.723 during the quarter ended Sept. 30, 1928. Total surplus and reserve for depletion was $13,678,845 at the end of the quarter.

American Zinc, Lead & Smelting Company, reports profit of $184,511 before depreciation or depletion for the quarter ended Sept. 30. Comparative figure for the second quarter of 1928 was $229,083, and $113,970 in the third quarter of 1927.

Chile Copper has announced a quarterly dividend of 75c. per share payable Dec. 29 to stock of record Dec. 5. This is an increase over the former quarterly dividend rate of 50c. per share.

Dome Mines, Ltd., reports for the nine months ended Sept. 30, 1928, a total of 410,400 tons of ore milled. Recovery amounted to $6.83 per ton, and totaled $2,804,002. Net income, including miscellaneous earnings, but before deduction for depletion or depreciation charges, was $1,334,529.

Howe Sound Company, operating the Britannia mine, in British Columbia, and the Calera mine and El Potosi mine, in Mexico, reports operations for the quarter ending Sept. 30, 1928, compared with the preceding quarter, as follows:

	Third Quarter	Second Quarter
Value of metals produced	$3,676,130	$3,949,541
Operating costs	2,874,387	3,159,523
Operating income	$801,742	$790,018
Miscellaneous income	91,100	106,063
Total income	$892,843	$896,081
Less depreciation	224,649	228,916
Net income	$668,194	$667.164

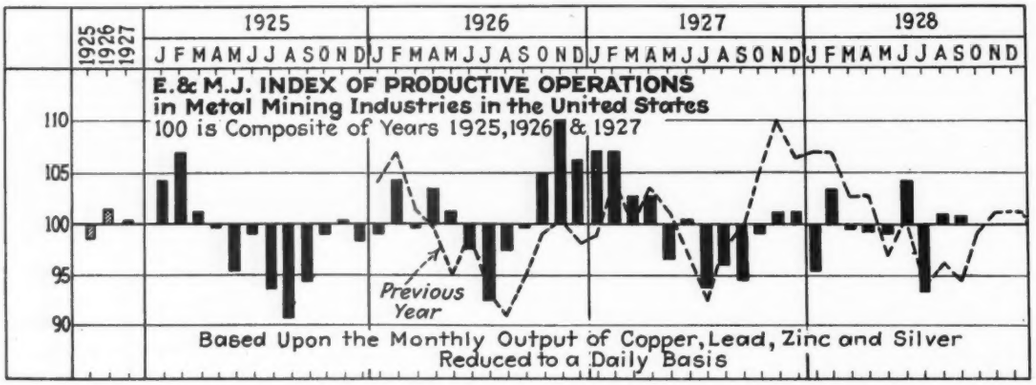
A distribution to stockholders of $1 per share on 496,038 shares was made on Oct. 15, 1928.

American Metal Company reports net earnings of $687,466 after depreciation and federal taxes for the third quarter of 1928. This compares with earnings of $640,850 in the preceding quarter and of $587,588 in the third quarter of 1927.

Anaconda Copper fifteen-year 7 per cent convertible debenture bondholders have been notified that a third $10,000,000 of debentures have been presented to the National City Bank of New York, trustee, for conversion into common stock at $59 per share. The next $10,000,000 of debentures to be presented for conversion may be converted at $62 a share. Upon presentation of the fourth lot for conversion at $62 per share, the price will advance to $65 a share for the remaining $10,000,000 principal amount.

Indicators of Industrial Activity

of Significance to Mining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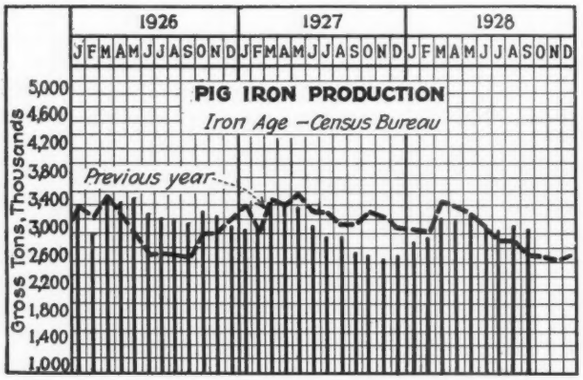
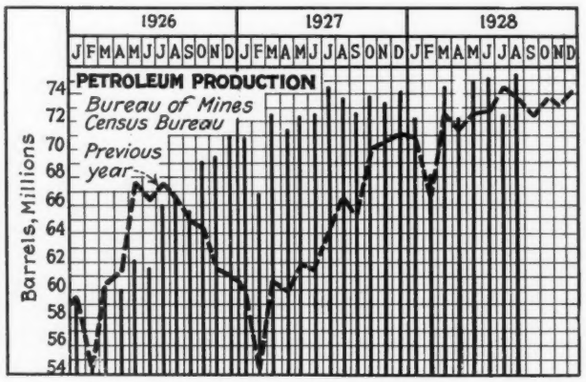
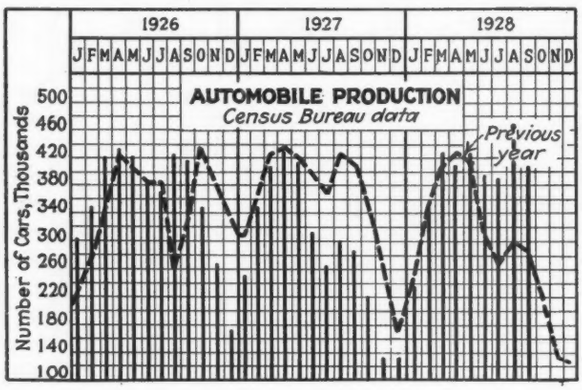
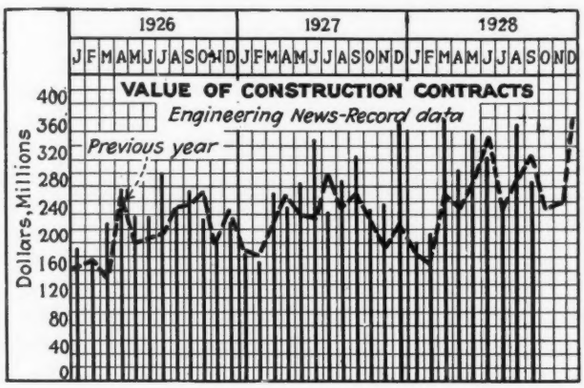
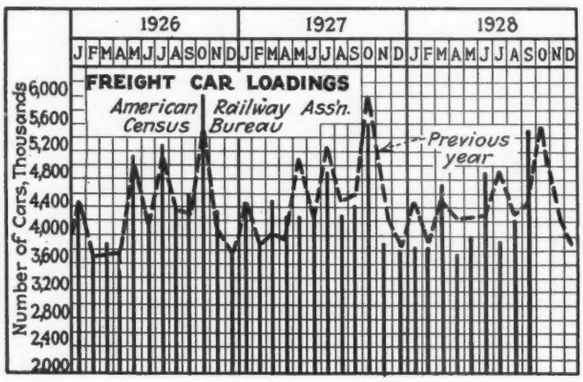
E.& M.J. INDEX OF PRODUCTIVE OPERATIONS
in Metal Mining Industries in the United States
100 is Composite of Years 1925, 1926 & 1927
110
105
100
95
90
Previous Year
Based Upon the Monthly Output of Copper, Lead, Zinc and Silver
Reduced to a Daily Basis

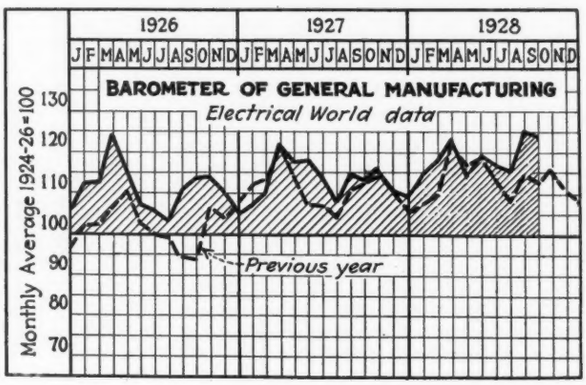












The Market Report

Copper Reaches 16c. After Heavy Sales

New York, Oct. 31, 1928.—Heavy copper sales at advancing prices have again been the feature of the non-ferrous metal markets in the week ending today, the market having reached 16c. per pound, delivered.

Copper Buying for January Requirements

The heavy sales of last week have been duplicated in the week ending today, though some sellers have limited their offerings, with the result that the business has not been so well distributed among the different producers as before. On Thursday, another quarter of a cent advance was made, to 15¾c. for Connecticut deliveries, but no cessation in demand resulted. Over the week-end the price advanced again to 16c., since which time the volume of sales has been smaller. One or two producers are now quoting 16¼c., but only one small lot has been reported sold at that price, and the sentiment among other sellers is against any further advance.

Most of the copper sold has been for January delivery, and it is thought that consumers' requirements for that month must now be pretty well taken care of. A small percentage, however, has been for December or February. The principal activity is apparently in the wire and sheet business, though the brass mills are also doing a record business.

The Copper Exporters advanced the c.i.f. price from 15¾ to 16c. on Oct. 26, and to 16¼c. on Oct. 30, accompanying the second advance with an announcement that it was the opinion of the producers that consumers were buying in excess of actual requirements and that if they were to temper their demands, increased mine production would be ample to take care of actual requirements, and a runaway market would be avoided. The statement applies to domestic consumers even more than to foreign buyers. It is probable that buyers of crude copper are not speculating, and are booking copper only sufficient to cover their orders, but the ultimate wholesale buyer of copper and brass products has, without doubt, been liberal in his estimates of future requirements.

Foreign sales in the month ending today have been heavy, even at the advanced prices, the tonnage being approximately the same as last month, around 85,000 long tons.

Average Metal Prices for October, 1928

COPPER:	
New York Electrolytic	15.202
London Standard Spot	65.524
London Electrolytic Spot	71.935
LEAD:	
New York	6.500
St. Louis	6.318
London Spot	22.082
London Forward	21.796
SILVER:	
New York	58.087
London	26.727
Sterling Exchange	484.584
ZINC:	
St. Louis	6.250
London Spot	24.030
London Forward	24.296
TIN:	
Straits	48.966
London	222.005
QUICKSILVER	125.923
ANTIMONY	10.841
PLATINUM:	
Refined	78.000
Crude	68.000
ALUMINUM 99 PER CENT PLUS.	24.300

Daily Prices of Metals

Oct.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
25	15.525	48.50	6.50	6.30@6.325	6.25
26	15.525	48.50	6.50	6.325	6.25
27	15.525	48 625	6.50	6.325	6.25
29	15.525@15.775	49 25	6.50	6.30@6.325	6.25
30	15.775	49.25	6.50	6.30@6 325	6.25
31	15.775	49.625	6.50	6.30@6 325	6.25
	15.629	48.958	6.500	6.317	6.250

Average prices for calendar week ending October 27, 1928, are: Copper, 15.400; Straits tin, 48.688; N. Y. lead, 6.500; St. Louis lead, 6.323; zinc, 6.250; and silver, 58.063.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
25	66 5/8	67 3/16	72 3/4	220 1/4	219 5/8	22 1/8	21 3/4	23 15/16	24 1/8
26	66 15/16	67 1/2	73 3/4	221	220	22 1/8	21 3/4	23 15/16	24 3/16
29	67 3/4	68 5/16	73 3/4	223 1/8	220 1/4	22 1/8	21 13/16	24 1/16	24 5/16
30	68 1/8	68 11/16	74 3/4	226 3/4	222 3/4	22 1/8	21 13/16	24 1/8	24 7/16
31	67 3/8	67 7/8	74 3/4	227 1/4	221 3/4	22	21 3/4	24 1/16	24 3/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
25	4.84 5/8	58 1/8	26 3/4	84s11½d	29	4.84 1/2	57 7/8	26 11/16	84s11½d
26	4.84 9/16	58 3/8	26 13/16	84s11½d	30	4.84 1/2	58	26 3/4	84s11½d
27	4.84 1/2	58 1/4	26 13/16	.....	31	4.84 7/16	58 1/8	26 3/4	84s11½d
					Ave.		58.125		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Lead Quiet; Prices Steady

Sales of lead during the week ending today have been in small volume; in fact the tonnage is the smallest reported during any corresponding period of the last four months. Prices are unchanged in the East, where the contract price of the American Smelting & Refining Company, 6.50c. per pound, ruled in all transactions reported. In the Mid-West market, the price has fluctuated between 6.30 and 6.325c. per pound, with the larger sellers doing routine business at the higher figure. Following the long sustained buying activity, the present quiet market is not unexpected. A continuation of the period of lessened activity until after the Presidential election is expected by some factors in the trade. London has been firm and steady during the past week. Australian shipments are again normal.

Zinc Unchanged

The zinc market has been quite active, as was the case last week, but galvanizers are not yet in any great rush to place orders. Some prompt sales have been made, but not enough to indicate that consumers are particularly under-bought, as has been supposed. The price is steady at 6¼c., East St. Louis, and High-Grade is nominal at 7½c., delivered, for spot carloads.

Tin Prices Higher

Indications of manipulation in the tin market during the last week have been most noticeable. The price of spot tin advanced 1⅛c. per pound, though consumer buying has been lacking. Domestic deliveries during October were disappointing. With stocks of tin higher by approximately 1,000 long tons at the end of the month, and world production increasing, the statistical position is none too strong.

Foreign Exchange

Closing cable quotations on Tuesday, Oct. 30, were: Francs, 3.90⅝c.; lire, 5.23⅞c.; and marks, 23.825c. Canadian dollars, 3/128 per cent discount.

Silver Market Quiet

Conditions in the silver market remain much the same as during the previous week. Buying for China account, with limited offerings, has helped to steady the market, and India still shows little interest at this level.

Mexican Dollars (Old Mexican pesos): Oct. 25th, 44c.; 26th, 44¼c.; 27th, 44⅛c.; 29th, 43¾c.; 30th, 43⅞c.; 31st, 44c.

Platteville, Wis., Oct. 27, 1928.

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$85.00

Shipments for the week: Blende, 878 tons; lead none. Shipments for the year: Blende, 31,227 tons; lead, 1,570 tons. Shipments for the week to separating plants, 1,521 tons blende.

Ore Selling Freely in Tri-State

Joplin, Mo., Oct. 27, 1928.

Blende	Per Ton
High	$42.35
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	39.00@ 40.00
Fines and slimes, 60 per cent zinc	36.00@ 38.00
Average settling price, all zinc	40.20
Galena	
High	$87.00
Basis 80 per cent lead	85.00
Average settling price, all lead	83.91

Shipments for the week: Blende, 11,202; lead, 3,652 tons. Value, all ores the week, $756,810.

Shipments for ten months: Blende, 466,108; lead, 81,038 tons. Value all ores ten months, $24,645,940.

Lead ore has moved more rapidly this month, reducing stocks to approximately 9,000 tons. Buyers of zinc concentrates this week purchased the largest tonnage of any one week since that of July 14.

Steel and Iron Markets Firm

Pittsburgh, Oct. 30, 1928 — October was a month of slightly lighter steel buying than September, but was so chiefly because in the earlier month buyers had made various forward commitments for special reasons, because mills were behindhand in making deliveries, because certain price advances were being made, and because the discount for cash was being reduced. These conditions did not apply generally, but only to certain lines.

Mills succeeded in their attempts to advance prices of bars, shapes, plates, sheets, and cold-rolled strips, whereas the attempt to advance hot-rolled strips virtually failed. Compared with a year ago bars, shapes, and plates are $3 to $4 a ton higher. Production costs in these lines have decreased somewhat.

The outlook is for continued heavy demand during the remainder of the year, except for some seasonal decrease, and for heavy demand in the new year.

Pig Iron—In all districts merchant furnaces have been asking higher prices, and in some districts there have been fair-sized sales at advances. The Valley furnaces have had a very light demand, and their higher prices have not been tested by any large inquiry. Bessemer, $17.50@$18; basic, $17@$18; foundry, $17@$17.50, f.o.b. Valley furnaces, with $1.76 freight to Pittsburgh.

Connellsville Coke—Demand has been slightly heavier all around. Spot furnace is up to $2.85@$3, spot foundry remaining at $3.75@$4.25.

Other Metals

Quotations cover large wholesale lots f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. Demand good. London, 98 per cent, quoted at £95 per long ton, less 2 per cent, for domestic consumption. Market dull.

ANTIMONY—Per lb., duty paid: Chinese brands, spot, 10¼c., futures 10¼@10⅛c. Cookson's "C" grade, spot, 15⅜c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 70@95c. Active. London, 4s. for Australian metal, early delivery.

COBALT — Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50@$3, quiet. Black oxide, 70 per cent, $2.10. London, 10s. for metal in small lots, 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE — Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $280@$300 for 98@99 per cent sponge and powder. London £57@£60.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM — Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x15 or 16 in.), 85c.@$1.05, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.), $0.90@$1.10, depending on quantity; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market firm. London 3s. 3d.@3s. 9d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM — Per gram, 99 per cent, 4c. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.90 per cent grade), for single lots of spot metal. Market active. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $55@$65; London, £12@£14.

PALLADIUM — Per oz., $42@$46. London, £10. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75@$76 asked. Market quiet.

London, per oz., £16 for refined; crude and scrap, nominal at £14½@£15. Market depressed.

QUICKSILVER—Per 76-lb. flask, $123. Small lots command the usual premium. Market very quiet. San Francisco wires $126.67, for retail and small wholesale lots. London quiet, with offers of spot at £23@£23¼.

RADIUM — Per mg. radium content, $70.

RHODIUM—Per oz., $40@$55. Nominal. London, £11@£12.

RUTHENIUM — Per oz., $45@$55. Nominal. London, £9@£10.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

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[1]Price furnished by Foote Mineral Co., Philadelphia.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

THALLIUM METAL — $12.50@$15 per lb.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., $1.10@$1.20, depending on quantity. Nominal.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

Metallic Ores

ANTIMONY ORE—Bolivian ore, 60 per cent metallic antimony, $1.40 per short ton unit, c.i.f. New York.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22 for 47 per cent Cr_2O_3 ore to $23 for 50@51 per cent ore. New Caledonian ore, high-grade, $25.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.25.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 8c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10@11c.

Spanish and North African basic, 50@60 per cent, 8½c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@9½c. Nominal.

Newfoundland foundry, 55 per cent, 8½c.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 35@38c. Caucasian (washed), 52@55 per cent, 38@40c. Market firm.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of Ta_2O_5, basis 60 per cent ore, $13.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per short-ton unit of WO_3, N. Y.: Wolframite, $11. Western scheelite, $11.50. Tendency reported toward higher labor costs in China, which may result in higher prices to American consumers.

VANADIUM ORE—Per lb. V_2O_5 contained, 25@28c.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $600@$650; crude No. 2, $375@$400; spinning fibers, $190@$225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $15. Market firm, demand good for all grades.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $7. Washed and water floated to 97 per cent through 300 mesh, $19. Shipments continue steady though below normal.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $6.50, f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8, f.o.b. *Georgia* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $7.50@$8.50 f.o.b. *Georgia-Alabama* mines. Pulverized and dried, $14; calcined, 78 to 84 per cent Al_2O_3, $18@$20.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.80@$6.50; Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 5 per cent SiO_2, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. consumers' shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York*, $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $8@$15; ground, $7@$10.

Florida, pressed pottery, bulk, $13; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour, No. 1, $20; No. 2, $17. Market fair.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots. Market somewhat improved.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $40@$45.

[1]Price furnished by Foote Mineral Co., Philadelphia.

DIATOMITE — Per short ton, f.o.b. producing plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45. 80 to 85 per cent silica, 98 per cent through 200 mesh, $20 in carload lots. Market fair.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $6@$7.50; glass grades, $5.50@$6. Market good.

No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12; 140 mesh, $13.75; 200 mesh, $15.50. No. 3, 20 mesh, $9. Market somewhat improved.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $9.

New York, Per ton: f.o.b. cars, No. 1 crude, $9. Market fair.

Maine, per ton: Best pottery grade, ground, $19. Market slow.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines.

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $19. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Prices advancing in anticipation of the effect of the recent tariff increase in curtailing importations of foreign ores. New tariff rate effective Nov. 16.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 96-3 sacked, $35.

Foreign spar, duty paid, $15.50, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 16 to 60 mesh, $17; 60 to 90 mesh, $14; 100 mesh up, $7. Market fair.

Powdered, import duty paid, $24@$25 per ton.

GARNET — Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb.: F.o.b. *New York*.

Ceylon lump, 8@8½c.; chip, 7@7½c.; dust, 3@5½c.; Madagascar flake, 6½@7½c.

No. 1 flake, 8c. and up. No. 2 flake, 6c. and up. Foundry facings, 3c. and up. Graphite facings, 3c. and up. Amorphous and crystalline, fine ground, 3c. and up. Market active but very competitive.

Crude amorphous graphite, $15@$35 per ton, according to grade. Slightly improved demand.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $25. Market improving.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$6; ground, $4@$9; agricultural, $4@$9; calcined, $6@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, 75c. up to $5 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $43; Grade B, $40; dead burned, $29; crude, $11; high-purity periclase, f.o.b. Eastern seaboard, calcined, $40. *Washington:* Dead-burned magnesite, $22@$24 per net ton, Chewelah, Wash.

MICA—Per ton, f. o.b. plant:

New Hampshire: Mine run, $320; clean shop scrap, $25; roofing, $24. White dry ground, 20 mesh, $25; 40 mesh, $38; 60 mesh, white, $60; off-color, $34; 100 mesh, $70; 200 mesh, $80. Granite-mica facings for cement block and stucco use, $8@$12, depending on size between ¼ in. and 10 mesh. Market fair.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York*, duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c. Market slow.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market good.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4.

Tennessee, ground, 90 per cent through 200 mesh, 33 per cent P_2O_5, $11.20 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton). Market active.

POTASH—The ruling contract prices are as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent....	36.40	34.80
Sulphate of potash 90 @ 95 per cent, basis 90 per cent....	47.30	45.70
Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent	27.25	25.65
Manure salt 30 per cent.....	21.75	18.75
Manure salt 20 per cent.....	15.40	12.40
Kainit 14 @ 16 per cent.....	12.50	9.50
Kainit 12.4 per cent.....	12.00	9.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur, Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. For optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $9.50@$10; 97½ to 98½ per cent through 200 mesh, medium white, $9@$9.50; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks.

New York: Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

New Jersey: Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream, $25; mill run, $15. Good fall business.

Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent Sb_2O_3, 15½c. per lb.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c.; delivered near by. Market firm. London, per long ton, £16½ quoted for Cornish white; Mexican high grade, £17 5s., c.i.f. Liverpool. Steady.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c., delivered. Good demand.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5.30@5.40c., for either large or small crystals. Quiet.

SODIUM NITRATE—Per 100 lb.; crude, in bags ex vessel, Atlantic ports, $2.15 for spot; future delivery, $2.17½@$2.20.

[1]Price furnished by Foote Mineral Co., Philadelphia.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $10@$18; in barrels, $21@$23.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

Alloys

[1]FERROCERIUM—Per lb., $9 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Spot shipments ½c. higher. Freight allowed in carload lots east of Mississippi River and north of Baltimore.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105. Spiegeleisen, 19@21 per cent, $33 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.20. Active demand.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $130; 15@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments slightly higher. Market active.

FERROCARBONTITANIUM — Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 96@98c., f.o.b. works.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, freight allowed, $3.15@$3.65, depending on grade and quantity.

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL SILVER—31c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 21½c. per lb.; rods, 18½c. per lb.

Rolled Metals

COPPER — Sheets, hot-rolled, 25c.; wire, 17⅞c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

ZINC SHEETS — Per lb., 9¾c., f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE—Brick, per net ton, f.o.b. works: 9-in. straights, $65. Cement, $40, seaboard.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York 1927	New York 1928	London Spot 1927	London Spot 1928	Sterling Exchange 1927	Sterling Exchange 1928
January	55.795	57.135	25.863	26.313	484.775	487.098
February	57.898	57.016	26.854	26 205	484.551	487 008
March	55.306	57 245	25.655	26.329	484.887	487 558
April	56.399	57.395	26.136	26.409	485.178	487.785
May	56.280	60.298	26.072	27.654	485.288	487.685
June	56.769	60.019	26.203	27.459	485.183	487.565
July	56.360	59.215	25.983	27.262	485.145	485.923
August	54.718	58.880	25.224	27.096	485.546	484.979
September	55.445	57 536	25.565	26 440	485.878	484 654
October	56.035	58.087	25.776	26.727	486.533	484.584
November	57.474	.....	26.526	.....	486.956	.....
December	57.957	.....	26.701	.....	487.714	.....
Year	56.370	.....	26.047	.....	485.636	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1927	New York Electrolytic 1928	London Spot Standard 1927	London Spot Standard 1928	London Spot Electrolytic 1927	London Spot Electrolytic 1928
January	12 990	13.854	55.414	61.912	62.375	66.575
February	12 682	13 823	54.438	61.670	61.119	66.381
March	13.079	13.845	55.935	61.148	62.641	66.443
April	12.808	13.986	55.056	61.678	61.526	66.500
May	12.621	14.203	54.563	62.554	60.881	67.216
June	12.370	14.527	54.030	63.664	59.881	68 738
July	12.532	14.527	54.551	62.881	60.089	68.670
August	12.971	14.526	55.364	62.472	62.227	68.750
September	12.940	14 724	54.455	63 522	61.830	69 800
October	12.958	15.202	55.119	65.524	62.256	71.935
November	13.319	.....	58.830	.....	63.761	.....
December	13.774	.....	60.078	.....	66.181	.....
Year	12.920	.....	55.653	.....	62.064	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York 1927	New York 1928	St. Louis 1927	St. Louis 1928	London 1927 Spot	London 1927 3 Mos.	London 1928 Spot	London 1928 3 Mos
January	7.577	6.500	7.392	6.280	27.485	27.786	21.773	22 213
February	7.420	6.329	7.286	6.069	27.344	27.781	20 283	20 747
March	7.577	6.000	7.328	5.805	27.845	28.302	19.938	20.352
April	7.126	6.100	6.807	5.991	26.546	27.053	20.306	20.563
May	6.616	6.123	6.269	6.012	25.054	25.526	20.483	20.813
June	6.414	6.300	6.150	6.152	24.438	24.750	20.985	21.211
July	6.344	6.220	6.120	6.038	23.491	23.932	20.602	20.957
August	6.681	6.248	6.367	6.056	23.119	23.540	21.634	21.628
September	6.297	6.450	6.044	6.286	21.446	21.994	22 050	21.769
October	6.250	6.500	6.013	6.318	20.479	20.946	22.082	21.796
November	6.259	.....	6.035	.....	20.889	21.318	.....	.....
December	6.504	.....	6.319	.....	22.163	22.441	.....	.....
Year	6.755	.....	6.511	.....	24.192	24.614	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York 1927 99%	New York 1928 99%	New York 1927 Straits	New York 1928 Straits	London 1927 Spot	London 1928 Spot
January	64.785	55.180	66.415	55.650	297.804	253.222
February	66.528	51 793	69.142	52 440	306.125	233.833
March	67.833	51.630	69.199	52.220	313.315	232.722
April	66.069	.....	67.933	52.270	302.572	234.204
May	63.935	.....	67.510	51.582	294.938	230.886
June	64.226	.....	67.466	47.938	296.006	217.280
July	62.625	.....	64.110	47.040	288.690	212.44
August	63.523	.....	64.431	48.012	293.193	212.847
September	60.735	.....	61.490	48 073	280.432	215.663
October	57.560	.....	58.450	48.966	264.631	222.005
November	57.089	.....	57.641	.....	262.591	.....
December	58.053	.....	58.452	.....	267.138	.....
Year	62.747	.....	64.353	.....	288.953	.....

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

Zinc

	St. Louis 1927	St. Louis 1928	London 1927 Spot	London 1927 3 Mos.	London 1928 Spot	London 1928 3 Mos.
January	6.661	5.643	30.979	30.938	26.125	26.051
February	6.673	5.551	29.931	30.109	25 518	25 506
March	6.692	5 624	30.649	30.889	25.082	24.960
April	6.338	5.759	29.579	29.901	25.493	25.316
May	6.075	6.026	29.034	29.131	26.102	25.756
June	6.213	6.158	28.598	28.613	25.664	25.429
July	6.229	6.201	28.280	28.021	24 946	24.972
August	6.342	6.249	28.210	28.068	24.540	24.713
September	6.212	6 250	27.347	27.327	24 497	24 625
October	5.996	6.250	26.899	26.634	24.030	24.296
November	5.745	.....	26.281	26.006	.....	.....
December	5.722	.....	26.363	26.109	.....	.....
Year	6.242	.....	28.513	28.479	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1927	Antimony (a) New York 1928	Quicksilver (b) New York 1927	Quicksilver (b) New York 1928	Platinum (c) Refined New York 1927	Platinum (c) Refined New York 1928	Platinum (c) Crude New York 1927	Platinum (c) Crude New York 1928
Jan	13.910	10.863	101.200	123.620	109.520	79.280	99.820	69.280
Feb	14.509	10 842	101.727	121 370	107.545	84 783	99.295	74.783
March	12.801	10.083	110.259	122.557	108.000	80.000	100.426	70.000
April	14.166	9.865	123.250	123 740	101.885	80 000	91.865	70.000
May	12.975	11.019	123.900	123.173	84.680	78.000	75.000	68.000
June	12.447	9.750	118.096	122.423	72.000	78 000	62.500	68.000
July	11.880	9.540	119.880	121.260	72.000	78.000	61.520	68 000
Aug	11.826	10.181	119.111	124.500	72.000	78.000	62.000	68.000
Sept	11.073	10.813	119.640	128 000	72.000	78.000	62.000	68.000
Oct	11.165	10.841	126.200	125.923	72.000	78.000	62.000	68.000
Nov	10.763	.....	127.708	.....	72.000	.....	62.000	.....
Dec	11.195	.....	126.933	.....	72.000	.....	62.000	.....
Year	12.393	.....	118.159	.....	84.636	.....	75.036	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

Pig Iron, Valley[1], and Aluminum

	Bessemer 1927	Bessemer 1928	Basic 1927	Basic 1928	No. 2 Foundry 1927	No. 2 Foundry 1928	Aluminum 1927	Aluminum 1928
Jan	19.50	17 50	18.16	17.00	18.50	17 25	26.270	24.300
Feb	19.02	17 50	18.00	17.00	18.50	17 25	26.000	24.300
March	19.37	17.50	18.28	17.00	18.50	17 25	26.000	24.300
April	19.50	17 50	19.00	17.00	18.50	17.24	26.000	24.300
May	19.24	17 37	18.24	16.38	18.50	16.79	26.000	24.300
June	18.96	17.00	17 96	15.56	18.35	16.79	26.000	24.300
July	18.50	17.00	17.50	15.75	18.00	16.69	26.000	24.300
Aug	18.50	17.00	17.32	15.75	17.65	16.50	26.000	24.300
Sept	18.00	17 00	17.11	15.75	17.50	16 50	26.000	24.300
Oct	18.00	17.24	17.00	16.71	17.50	16.74	25.600	24.300
Nov	18.00	.....	17.00	.....	17.47	.....	25.000	.....
Dec	17.69	.....	17.00	.....	17.25	.....	24.785	.....
Year	18.69	.....	17.71	.....	18.02	.....	25.808	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

Monthly Crude Copper Output in Short Tons

Domestic

	1928 April	1928 May	1928 June	1928 July	1928 Aug.	1928 Sept.
Alaska shipments	2,084	1,767	2,351	999	2,219	661
Calumet & Arizona	2,102	2,726	1,991	1,593	2,205	2,337
Magma	1,525	1,451	1,593	1,584	1,427	1,678
Miami	2,092	2,185	2,055	1,756	1,924	1,770
New Cornelia	3,224	2,924	3,050	2,989	3,673	3,230
Nevada Con	.....	.....	†31,854	.....	.....	.....
Old Dominion*	988	1,010	882	819	968	818
Phelps Dodge††	8,334	8,083	8,887	8,193	9,330	7,892
United Verde Extension	1,604	1,724	1,670	1,793	2,027	1,757
Utah Copper	.....	.....	†30,296	.....	.....	.....
Tennessee Copper	526	582	527	541	574	594

Foreign

Andes Copper	2,152	2,816	4,114	4,315	.....	.....
Braden	8,506	9,544	8,129	9,079	.....	.....
Boleo, Mexico	1,012	953	882	.....	.....	†3,053
Bwana M'Kubwa	392	556	542	629	499	556
Chile	8,155	8,787	9,785	9,969	.....	.....
Furukawa, Japan	1,559	1,286	1,350	1,274	1,536	.....
Granby Cons., Canada	2,406	2,505	2,345	2,492	2,517	2,445
Howe Sound	.....	.....	†5,851	.....	.....	†5,039
Mount Lyell, Australia	.....	.....	†1,594	.....	.....	†2,274
Sumitomo, Japan	1,483	1,475	1,347	1,611	1,643	.....
Union Miniere, Africa	10,780	10,689	10,120	10,820	10,775	10,248

†Three months. *Includes Arizona Commercial
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1926 Monthly Production	1926 Daily Rate	1927 Monthly Production	1927 Daily Rate	1928 Monthly Production	1928 Daily Rate
January	71,026	2,291	76,198	2,458	68,469	2,209
February	68,131	2,433	69,202	2,472	67,423	2,325
March	75,728	2,443	69,314	2,236	70 327	2,269
April	73,454	2,448	71,122	2,371	69,721	2,324
May	73,542	2,372	71,613	2,310	73,729	2,378
June	71,317	2,377	69,539	2,318	73,224	2,441
July	72,228	2,330	65,545	2,114	73,426	2,369
August	72,014	2,323	67,248	2,169	76,952	2,482
September	72,672	2,421	65,936	2,198	77,387	2,580
October	75,099	2,423	68,595	2,225	.....	.....
November	74,947	2,498	68,080	2,269	.....	.....
December	72,205	2,329	67,377	2,173	.....	.....
Total	872,509	.....	829,878	.....	650,658	.....
Monthly average	72,709	.....	69,165	.....	72,295	.....
Average of daily rate	.....	2,390	.....	2,274	.....	2,375

Mining Stocks—Week Ended October 27, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	89¼	87	88½	Oc.13, No. 19 Q	1.00
Ariz. Com'l	Boston	5	4½	4⅝	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz	New York	120½	114¾	116½	Se. 7, Se. 24 Q	1.50
Calumet & Hecla	Boston	43	42½	45½	No. 30, De.15,Q	1.00
Cerro de Pasco	New York	106¼	100	104½	Oc.11, No. 1 Q	1.25
Chile Copper	New York	60⅜	57½	59½	De.5 , De.29 Q	0.75
Con. Coppermines	N. Y. Curb	15½	12¾	14⅜		
Copper Range	Boston	24	22⅞	23¼	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*30	*25	*25		
East Butte	Boston	5	3½	4⅞	Dec., 1919	0.50
Granby Consol	New York	75¾	70½	74¼	Oc.11, No.1 Q	1.00
Greene Cananea	New York	144¼	130⅝	139⅞	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	68⅛	65⅞	66	Se 29, Oc. 15, Q	1.00
Inspiration Consol	New York	31⅜	29¾	30⅜	Apr. 1927 Q	0.25
Isle Royale	Boston	26⅞	24	25½	Au.31, Se.15SAX	0.75
Kennecott	New York	122¼	111⅛	121½	Au.31, Oc 1 Q	1.50
Magma Copper	New York	62½	59⅜	61	Oc.1, Oc.15 Q	0.75
Mason Valley	N. Y. Curb	1⅞	1⅜	1⅜		
Miami Copper	New York	26⅝	24½	26½	No.1, No.15, Q	0.37½
Mohawk	Boston	51⅛	50⅜	51	Oc. 31, De. 1 Q	3.00
Montana-Idaho	Spokane	*13¾	*11	*11¼		
Mother Lode Coal	New York	4⅛	3⅛	3⅜	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	33⅛	29⅜	32⅜	Se.14, Se.29 Q	0.37½
New Cornelia	Boston	36⅛	34	34	No.2, No. 19 Q	0.50
Noranda	N. Y. Curb	60½	57	57		
North Butte	Boston	5	4½	4⅞	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*80	*71	*77	Sept., 1926	0.03
Old Dominion	Boston	15⅜	14⅜	15	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	198	189	189½	Se.10, Oc.1 Q	2.00
Quincy	Boston	45	42⅜	43	March, 1920	1.00
St. Mary's Min. Ld	Boston	34⅛	33⅛	34	Ap.1928 A	2.00
Seneca Copper	New York	7¼	5⅛	5⅜		
Shattuck-Denn	N. Y. Curb	19	17⅜	17⅞		
Tenn. C. & C	New York	17⅜	15⅜	17	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	25½	21⅛	23	Oc.6, No.1 Q	0.50
Utah Copper	New York	200	200	200	Se.14, Se.29 Q	2.00
Utah Metal & T	Boston	1 1/16	1⅛	1¼	Dec., 1917	0.30
Walker Mining	Salt Lake	1.85	1.77½	1.85		
NICKEL-COPPER						
Internat. Nickel	New York	187¼	170½	174¼	Se.10, Se.29 Q	0.75
Internat. Nickel pfd	New York	121	115½	121	Oc.1, No.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*5½	*4½	*4⅜	June, 1927	0.005
National Lead	New York	124	120	120	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	142½	142	142	No.3, De.15 Q	1.75
National Lead, pfd. B	New York	118	118	118	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	47	45	45½	Se.8, De.20 QX	0.75
ZINC						
Am. Z. L. & S	New York	50	41⅛	43⅝	May, 1917	1.00
Am. Z. L. & S. pfd	New York	106	100	101½	Nov., 1920	1.50
Butte C. & Z	New York	11⅜	8⅜	10⅜	De., 1926	0.50
Butte & Superior	New York	13⅞	11	12⅜	Se.14,Se.29 Q	0.50
Callahan Zn-Ld	New York	4	3½	3⅞	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	11¼	11	11¼	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	19	18¼	19	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati			100	July 15 Q	1.50
Evans-Wallower	N. Y. Curb	7⅜	6⅞	7¼		
New Jersey Zn	N. Y. Curb	233¾	226	231	Oc.20, Nov. 10 Q	2.00
Treadwell-Yukon	Toronto	12	11	11		
United Zinc	N. Y. Curb	*65	*60	*65		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	9⅛	7⅛	7⅛		
Ankerite	Toronto			*28		
Barry-Hollinger	Toronto	*42	*37	*39		
Central Manitoba	Toronto	*96	*85	*90		
Cresson Consol. G	N. Y. Curb	*75	*69	*70	Oct. 15, Q	0.02
Dome Mines	New York	9	8⅛	8⅛	Se.29, Oc.20 Q	0.25
Gold Hill	Toronto	*8½	*7½	*7½		
Golden Cycle	Colo.Springs	†1.63	†1.61		My. 31, Je.10 Q	0.04
Hollinger Consol	Toronto	10.55	9.50	9.50	Oc 17, No. 3 FW	0.05
Homestake Mining	New York	78⅜	75½	78	Oc.20, Oc. 25 M	0.50
Kirkland Lake	Toronto	1.24	1.15	1.18		
Lake Shore	Toronto	21.00	19.90	20.80	Se.1, Se.15 XQ	0.20
McIntyre Porcupine	New York	24	20⅜	20⅜	No.1, De.1 Q	0.25
Portland	Colo.Springs	†*17	†*15		Ap., 1927	0.02
Rand Mines	New York	36½	36½	36½	Au.21-28 Am.Sh	1.52
Sylvanite	Toronto	2.45	2.25	2.30		
Teck-Hughes	Toronto	8.90	8.40	8.50	Oc.17, No.1	0.15
Tom Reed	Los Angeles	*58	*50	*58	Dec., 1926	0.02
Tough-Oakes	Toronto	*14½	*10	*13		
Vipond Cons	Toronto	*59	*57½	*57½	April, 1927	0.03
Wright-Hargreaves	Toronto	2.95	2.51	2.90	Oc.16, No.1 Q	0 02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	23⅜	22	22⅜		
Con. Cortez	N. Y. Curb	*21	*21	*21		
Dolores Esperanza	N. Y. Curb	*90	*86	*90	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			16	Oc.17, Oc.27 QX	0.50
Premier Gold	N. Y. Curb	2 7/16	2⅛	2 1/16	Se.14, Oc.4 Q	0.06
Tonopah Belmont	N. Y. Curb	*76	*75	*75	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb			*7	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4	3⅜	4	Se 29,Oc 20 SA	0.07½
West End Consol	N. Y. Curb	*3	*3	*3	Mar., 1923	0.05
Yukon Gold	Boston Curb	*72	*61	*72	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*76	*66	*76	May, 1920	0.03
Castle-Trethewey	Toronto	*37	*36	*37		
Coniagas	Toronto	2.95	2.95	2.95	May, 1924	0.12
Keeley	Toronto	*43⅜	*40	*40	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto			*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.25	3.00	3.10	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3⅜	2⅜	2⅜	Se.29, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	4	3½	3⅝	Ap., 1927	0 12½
Bingham Mines	Boston	48	48	48	Se 20, Oc.5 Q	0.50
Bunker Hill & Sullivan	N. Y. Curb	125	120	125	Se.29, Oc. 4 MX	0.75
Cardiff M. & M	Salt Lake	*35	*31½	*34½	Feb. 5, 1927	0 10
Chief Consol	Salt Lake	4.25	3.92½	4.12½	Ja.16, Fe.1 K	0 10
Consti'n Mng.&Mill'g	Spokane	*38	*38	*38		
Erupcion	Boston Curb	*25	*25	*25	Ja , 1928 Q	0.07½
Eureka Lily	Salt Lake	1.62½	1.57½	1.62½		
Federal M. & S	New York			161	Je., 1927	10.00
Federal M. & S. pfd	New York			101½	Au. 24, Se. 15 Q	1.75
Golconda	Spokane	*78½	*72½	*78½		
Hecla Mining	N. Y. Curb	15⅜	14⅞	15⅜	Au.15, Se. 1 Q	0.15
Highland-Surprise	Spokane	*12¾	*11	*12¾		
Iron King Mining	Salt Lake	*90	*90	*90		
Keystone Mining	Salt Lake	†*35	†*24		Fe., 1926	0.07½
Lucky Jim	Spokane	*24½	*24	*24		
Lucky Tiger-Com	Kansas City	†6.65	†6.50		Oc.4, Oc.20 M	0.05
Mammoth Mining	Salt Lake	†1.40	†1.30		De., 1926	0.25
North Lily	Salt Lake	7.90	7.80	7.90	Oct., 20 I	0.20
Park Utah	New York	11¼	10¼	10⅜	Se.,11, Oc.1 Q	0.20
Plutus Mining	Salt Lake	†2.00	†1.50		Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*49½	*49	*49½	June 15 Q	0.03
Sherman Lead	Spokane	*22	*20	*21		
Silver King Coal	Salt Lake	13.50	13.25	13.37½	Se.20, Oc.1 Q	0.25
Silversmith	Spokane	*10⅜	*9½	*10	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.43	1.25	1.30		
Sunshine M. Co	Spokane	1.36	1.30	1.30	June 20, K	0.02
Tamarack-Custer	Spokane	*40½	*36	*38	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.75	13.50	13.50	Se.19, Se.29 QX	0.30
Utah-Apex	Boston	4⅛	3⅞	3⅞	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	69⅜	65½	66½	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	1.49	1.19½	1.44	Oc.15, Oc.25. Q	1.00
Colorado F & I, pfd	New York	68⅞	65½	66	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	33⅜	27½	28	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	72⅞	70	70⅜	Au 15, Se.1 Q	0.62½
Republic I. & S	New York	83½	78	80	No. 14, De. 1 Q	1.00
Republic I. & S. pfd	New York	108½	107¼	108½	De. 14, Ja. 2 Q	1.75
Sloss-Sheffield S. & I	New York	118	118	118	Se.10, Se.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	104½	104½	104½	Se. 20, Oc. 1 Q	1.75
U. S. Steel	New York	166½	159¼	161½	Au.30, Se.29 Q	1.75
U. S. Steel, pfd	New York	142½	141⅜	142½	Au. 6, Au. 30 Q	1.75
Virginia I. C. & C	New York	25½	25½	25½	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	50	47	47	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			24½	Ju.16, Ju.26 K	0.97
So. Am. G. & P	N. Y. Curb	3½	3⅛	3⅛		
Alum. Co. of Amer	N. Y. Curb	139¾	137	137		
Alum. Co. of Amer. pf	N. Y. Curb	107⅞	107	107	Se. 15, Oc. 1 Q	1.75
Vanadium Corp	New York			79⅞	No. 1, No. 15 Q	0.75
Patino M. & E	New York	36½	33⅝	34⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	27	22½	25	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	85⅜	75	76	Se.29, Oc 15 Q	1.75
SULPHUR						
Freeport Texas	New York	48¼	43	45⅝	Oc.15, No 1 QX	1.25
Texas Gulf	New York	73½	70½	71⅛	Se. 1⅛, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	52	49⅞	50½	No. 20, De 1 Q	0.75
Amer. Metal, pfd. 6%	New York	112	112	112	No.20, De.1 Q	1.50
Amer. Sm. & Ref	New York	272⅜	263	272¾	Oc.11, No.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	137	137	137	No.2, De. 1 Q	1.75
Consol. M. & S	Montreal	294	272	283	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	189	178	184½	Se.28, Oc 15 Q	1.00
U. S. Sm. R. & M	New York	58⅜	52⅜	56½	Oc.5, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54	53	54	Oc. 5, Oc. 15 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS —WEEK ENDED October 16, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35/6	35/—	35/—			
Alaska Treadwell ($25)	120/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	61/3	58/9	58/9	Aug., 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	15/—	14/6	14/6	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	7/7½	7/—	7/1½			
Camp Bird (2s)	4/4½	4/—	4/—	April, 1928	16⅔ p.c.	
El Oro (£1)	5/4½	4/10½	5/1½	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	11/—	10/—	10/—	July 1928	3⅓ p.c.	
Mexican Corpn.(£1)	11/1½	10/—	10/9			
Mexico Mines of El Oro (£1)	35/7½	25/—	30/—	Dec., 1926	3⅓ p.c.*	
Mond Nickel	140/—	130/7½	136/3	Aug., 1928	20 p.c.	
Mount Isa (£1)	32/6	31/6	31/10½			
N'Changa Copper Mining	19/10½	18/6	19/—			
Oroville Dredging (£1)	3/9	3/3	3/6	Dec., 1923	3⅓ p.c.	
Rhodesian Congo Border (£1)	30/—	29/9	30/—			
St. John del Rey (£1)	13/6	12/6	12/9	April, 1928	7½ p.c.	
San Francisco Mines (10s)	28/7½	28/—	28/6	July 1928	12½ p.c.	
Santa Gertrudis (£1)	15/6	15/—	15/1½	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	9/1½	8/—	8/3	April, 1917	6⅓ p.c.	
S. Amer. Copper (2s.)	2/6	2/1½	2/3	Nov., 1917	75 p.c.	
Tanganyika (£1)	60/3	58/6	59/4½	July 1928	5 p.c.	
Union Miniere du Haut-Katanga (Brussels)	10,950	10,600	10,675	July, 1928	182.60 (b)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.